06.

- **Voltage:** The voltage between two points will be one volt, if it requires one Joule of energy to move one Coulomb of charge from one point to another.

$$V = \frac{W}{Q}$$

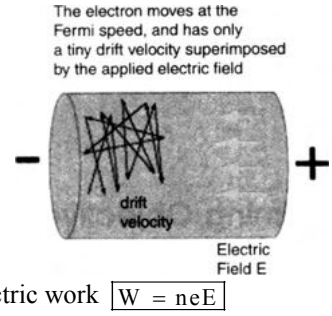
Where, V→voltage, W→energy, Q→Charge

- **Current:** One ampere is the current in a circuit when one Coulomb of charge passes a given point in one second.

$$I = \frac{Q}{t}$$

Where, I→ Current in ampere
Q→ Charge
t→ time

- **For a conductor material–**



- The electric work $W = neE$
- Drift velocity $V_d = \mu E$
- Drift current $i = neAV_d$
- Current Density $J = \frac{i}{A} = neV_d$

  or $J = ne\mu E$
- Current density $\propto$ apply electric field
  $J \propto E$

$$J = \sigma E$$

where $\sigma =$ conductivity of material

$\sigma = ne\mu$

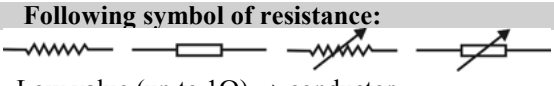
- Resistivity of material $\rho = \frac{1}{\sigma} = \frac{1}{ne\mu}$

Where
n = Number of free electrons available per m^3 of the conductor material it is depend on the mobility of electron.
e = Charge of each electron
E= Applied electric field across conductor
A= Area of cross-section of the conductor
μ = Mobility of electron

- Low density material⇒silver, gold, copper, alluminium etc.
- **Resistance-** It may be defined as the property of a substance due to which it opposes the flow of electricity through it. It is represented by R.

Basic Electricity

☛ **Following symbol of resistance:**



- Low value (up to 1Ω) → conductor
- Medium value (1Ω to 0.1MΩ) → resistor
- High value (0.1MΩ above)→Insulator

■ **The unit of resistance-** The practical unit of resistance is ohm. "A conductor is said to have a resistance of one ohm if it permits one ampere current to flow through it when one volt is impressed across its terminals."

➲1 Mega ohm = 10^6 ohm ➲ 1 Kilo ohm = 10^3 ohm.
➲1 Milli ohm = 10^{-3} ohm. ➲1 Micro ohm = 10^{-6} ohm.

■ **Law of Resistance-**

The resistance R offered by a conductor depends on-

- It varies inversely as the cross-section A of the conductor.
- It varies directly as its length *l*.
- It also depends on the temperature of the conductor.
- It depends on the nature of the material.

$$R \propto \frac{\ell}{A} \text{ or } R = \rho\frac{\ell}{A} \qquad ...(i)$$

Where ρ is a constant depending on the nature of the material of the conductor and is known as its specific resistance or resistivity.

If in equation --- (i)

l = 1 meter and A = 1 meter^2 then R = ρ

Hence, specific resistance of a material may be defined as the resistance between the opposite forces of a metre cube of that material.

■ **Units of Resistivity-** $R = \rho\frac{l}{A}, \rho = \frac{AR}{l}$

$$\rho = \frac{A(\text{meter})^2 \times R(\text{ohm})}{l(\text{meter})} = \frac{AR}{l}\text{ohm-meter}$$

● Hence the unit of resistivity is ohm-meter (Ω-m)

Resistivity of some conductors, semiconductor and insulating materials:

Material	Resistivity (Ωm)	Classification
Silver	1.6×10^{-8}	Conductor
Copper	1.7×10^{-8}	
Gold	2.4×10^{-8}	
Aluminium	2.6×10^{-8}	
Tunguston	4.9×10^{-8}	
Germanium	0.65	Semiconductor
Silicon	2×10^{3}	
Porcelain	3×10^{9}	Insulator
Glass	1.7×10^{11}	
Mica	9×10^{12}	
Hard rubber	1×10^{16}	

■ **Conductance and conductivity-**

- Conductance (G) is reciprocal of resistance.

$$G = \frac{1}{R}$$

- It offers to the flow of current.

$$R = \rho\frac{\ell}{A} \text{ or } G = \frac{A}{\rho\ell} = \frac{\sigma A}{\ell} \qquad ...(i)$$

σ = conductivity or specific conductance

- The unit of conductance is Siemens(s) or mho.

in equation ……(i)

The conductivity of a material is given by.

$$\sigma = G\frac{\ell}{A} = \frac{G(\text{Siemens}) \times \ell(\text{meter})}{A\left(\text{meter}^2\right)} = \text{Siemens/metre}$$

- The unit of conductivity is Siemens/metre (s/m)

■ **Effect of temperature on resistance-**

□ **Temperature coefficient of resistance.**

Let a metallic conductor having a resistance of R_o at 0ºC be heated of tºC and let its resistance at this temperature be R_t. Then considering normal ranges of temperature, it is found that the increase in resistance $\Delta R = R_t - R_o$ depends.

- directly on its initial resistance.
- directly on the rise in temperature.
- on the nature of the material of the conductor.

$R_t - R_0 \propto R_0$

or $R_t - R_o = \alpha R_o t$ ...(i)

Where α(alpha) is a constant and is known as the temperature coefficient of resistance of the conductor.

from equation ...(i)

$$\alpha = \frac{R_t - R_o}{R_o t} = \frac{\Delta R}{R_o t}$$

$R_o = 1\Omega$ $t = 1$ºC then $\alpha = \Delta R = R_t - R_o$

Hence, the temperature coefficient of material may be defined as.

"The increase in resistance per ohm original resistance per ºC rise in temperature"

- Suppose a conductor of resistance R_o at 0ºC is heated to tºC. Its resistance R_t after heating is given by- $R_t = R_o\left(1 + \alpha_o t\right)$

α_o is the temperature coefficient at 0ºC.

- In case R_o is not given the relation between the known Resistance R_1 at t_1ºC and the unknown resistance R_2 at t_2ºC can be found as follows.

$R_2 = R_o(1 + \alpha_0 t_2)$ and $R_1 = R_o\ (1 + \alpha_0 t_1)$

$$\frac{R_2}{R_1} = \frac{1 + \alpha_0 t_2}{1 + \alpha_0 t_1} \qquad R_2 = R_1\left[1 + \alpha_0\left(t_2 - t_1\right)\right]$$

☛ **Effect of temperature on materials resistance-**

According to the general rule, the dependence of resistance on temperature is that the resistance increases as the temperature increases in conductors and decreases with the increasing temperature in insulators.

☛ Temperature Coefficients of Resistance at 20°C:

Material	α (per degree Celsius)
Nickel	0.0059
Iron	0.0057
Aluminum	0.0043
Copper	0.0042
Silver	0.0038
Platinum	0.0037
Gold	0.0037
Zinc	0.0038

Colour Coding of Resistance

Colour	Value	Multiplier	Tolerance
Black	0	1	–
Brown	1	10	± 1%
Red	2	10^2	± 2%
Orange	3	10^3	± 3%
Yellow	4	10^4	± 4%
Green	5	10^5	± 0.5%
Blue	6	10^6	± 0.25%
Violet	7	10^7	± 0.10%
Grey	8	10^8	± 0.05 %
White	9	10^9	–
Gold	–	10^{-1}	± 5%
Silver	–	10^{-2}	± 10%
(None)	–		± 20%

- **Formula for 4 Band Resistor**

☞ $R = AB \times 10^C \pm \text{Tolerance}$
Where $A \rightarrow I^{st}$ significant digit
$B \rightarrow 2^{nd}$ Significant digit
$10^C \rightarrow$ multiplier

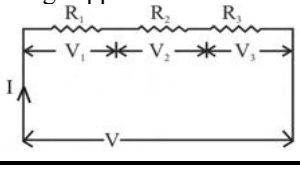
■ **Ohm's law-** "The ratio of potential difference (V) between any two points on the conductor to the current (I) flowing between them is constant provided the temperature of the conductor does not change."

In other words. $\frac{V}{I}$ = constant or $\frac{V}{I} = R$

Where R is the resistance of the conductor between the two point considered for silicon carbide the relationship is given by $V = KI^m$ where K and m are constants and m is less than unity. It also does not apply to non-linear devices such as zener diodes and voltage regulator (VR) tubes.

■ **Resistances in series-** When some conductors having resistances R_1, R_2 and R_3 etc. are joined end-on-end are said to be connected in series. It can be proved that the equivalent resistance or total resistance between point A and D is equal to the sum of the three individual resistances.

- Current is the same through all the three conductors.
- Voltage drop across each is different due to its different resistance and is given by ohm's law.
- Sum of the three voltage drops is equal to the voltage applied across the three resistance.

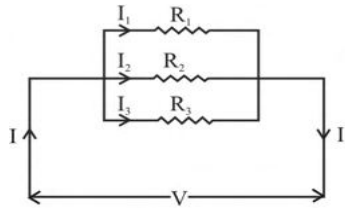


$V = V_1 + V_2 + V_3$
$IR = IR_1 + IR_2 + IR_3$
$\boxed{R = R_1 + R_2 + R_3}$

- All resistance are additive.
- All voltage drop are additive.
- Different resistors have their Individual voltage drop.
- Power are additive.

■ **Resistance in parallel-** When some conductors having resistance R_1, R_2 and R_3 are connected in parallel then-

- The total current is the sum of the three separate currents.
- Potential drop across all resistances is the same
- Current in each resistor is difference and is given by ohm's law.

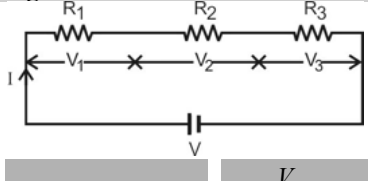


$$I = I_1 + I_2 + I_3,\ I = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}, \quad \boxed{\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$$

- All conductance's are additive.
- All branch currents are additive.
- Different resistance have their individual current.
- Powers are additive.

Voltage Divider Rule–



$$R_{eq} = R_1 + R_2 + R_3, \quad I = \frac{V}{R_{eq}} = \frac{V}{R_1 + R_2 + R_3}$$

$$\because V_1 \quad IR_1$$
$$V_2 \quad IR_2$$
$$V_3 \quad IR_3,$$

$$V_1 \quad IR_1, \quad V_1 = \left(\frac{V}{R_{eq}}\right) R_1$$

$$\boxed{V_1 = \left(\frac{R_1}{R_{eq}}\right) V}$$

Similarly-

$$\boxed{V_2 = \left(\frac{R_2}{R_{eq}}\right) V}, \quad \boxed{V_3 = \left(\frac{R_3}{R_{eq}}\right) V}$$

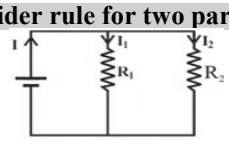
$\therefore$ From $V_1 = \left(\frac{R_1}{R_{eq}}\right) V$, $\boxed{V_1 \quad \frac{R_1}{R_1 \quad R_2 \quad R_3} \quad V}$

Similarly ,

$$\boxed{V_2 \quad \frac{R_2}{R_1 \quad R_2 \quad R_3} \quad V}, \quad \boxed{V_3 = \left(\frac{R_3}{R_1 + R_2 + R_3}\right) V}$$

$$\boxed{V_1 : V_2 : V_3 = R_1 : R_2 : R_3}$$

Current divider rule for two parallel resistances-

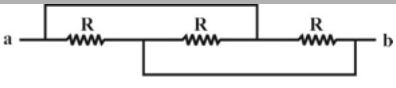


According to current division rule-

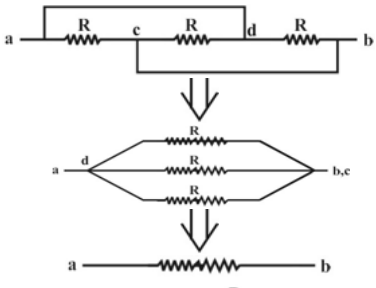
$$I_1 = \frac{R_2}{R_1 + R_2} I \quad , \quad I_2 = \frac{R_1}{R_1 + R_2} I$$

Different combination of resistance:

Type-I

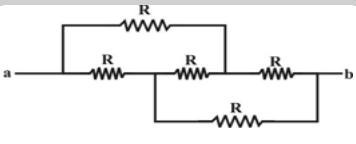


Solution–

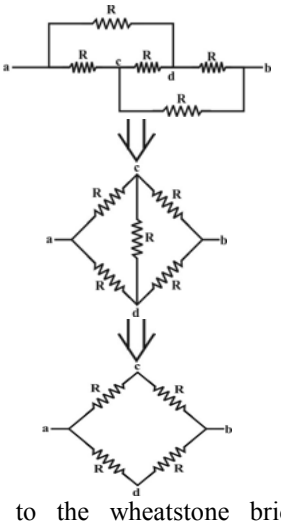


$$R_{ab} = \frac{R}{3}$$

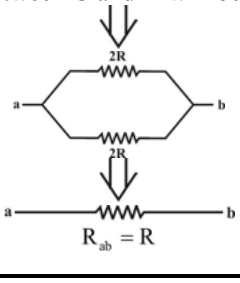
Type-II



Solution–

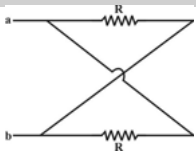


- According to the wheatstone bridge rule, the resistance between C and D will be negligible.

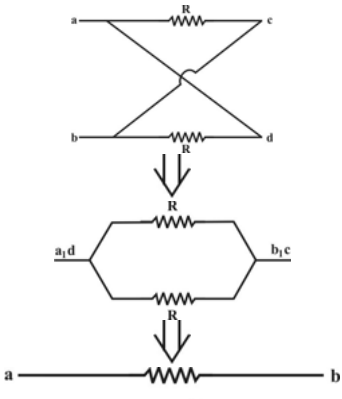


$R_{ab} = R$

Type-III

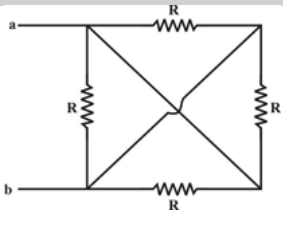


Solution–

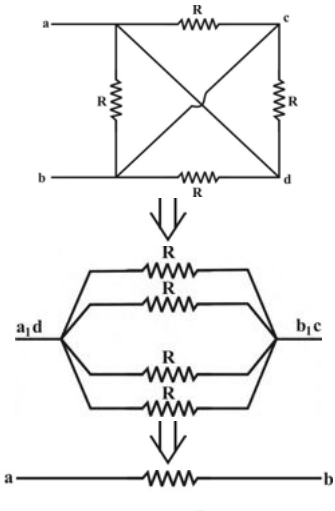


$$R_{ab} = \frac{R}{2}$$

Type-IV

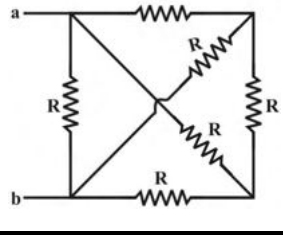


Solution–

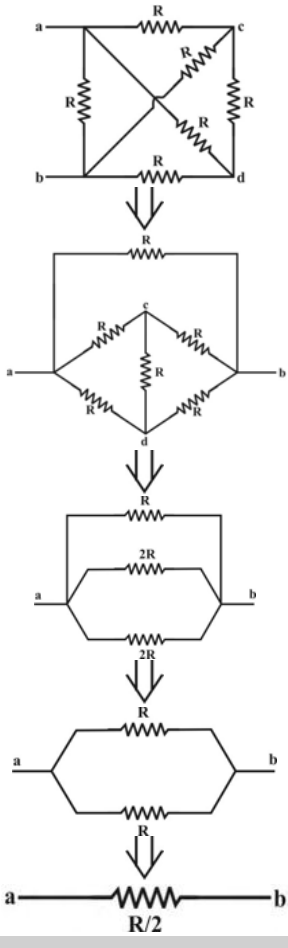


$$R_{ab} = \frac{R}{4}$$

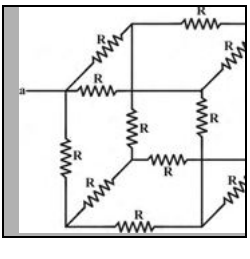
Type-V



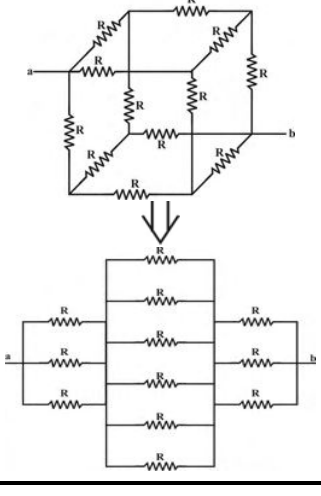
Solution–

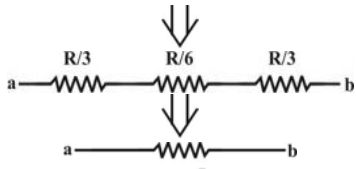


Type-VI



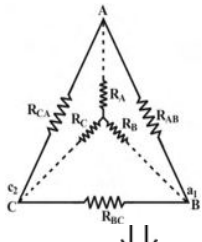
Solution–

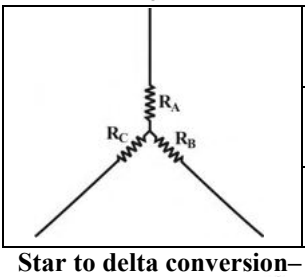




$$R_{ab} = \frac{5}{6}R$$

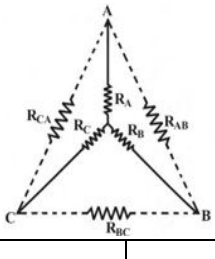
- **Delta to star conversion–**

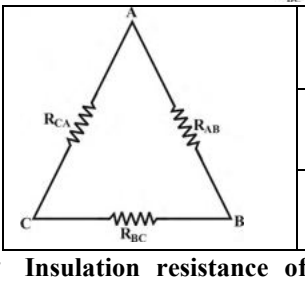




R_A	$\dfrac{R_{AB}\ R_{CA}}{R_{AB}\ R_{BC}\ R_{CA}}$
R_B	$\dfrac{R_{AB}\ R_{BC}}{R_{AB}\ R_{BC}\ R_{CA}}$
R_C	$\dfrac{R_{BC}\ R_{CA}}{R_{AB}\ R_{BC}\ R_{CA}}$

- **Star to delta conversion–**

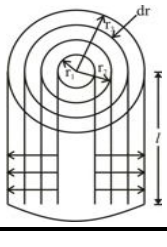




R_{AB}	R_A	R_B	$\dfrac{R_A R_B}{R_C}$
R_{BC}	R_B	R_C	$\dfrac{R_B R_C}{R_A}$
R_{CA}	R_C	R_A	$\dfrac{R_C R_A}{R_B}$

- **Insulation resistance of cable capacitor-** In a cable capacitor useful current flows along the axis of the core but there is always present some leakage of current in radial that is at right angles to the flow of useful current. The resistance offered to this radial leakage of current is called insulation resistance of the cable.

$$R = \frac{\rho}{2\pi l}\log_e\left(r_2/r_1\right)$$



$$= \frac{2.303\rho}{2\pi l}\log_{10}\left(\frac{r_2}{r_1}\right)$$

- The R is inversely proportional to the cable length.
- The R depends upon the ratio r_2/r_1 and not on the thickness of insulator itself.

Some important facts regarding the conductor-

- If the resistance of a conductor is R_1 and its length is increased n times, then the resistance of the conductor (R_2)-

$$\because l_2 \quad nl_1$$

$$\boxed{R_2 \quad n^2 R_1} \qquad a_2 \quad \frac{a_1}{n}$$

- If the resistance of a conductor is R_1 and its area is increased n times, then the resistance of the conductor (R_2)-

$$\because a_2 \quad na_1$$

$$\boxed{R_2 \quad \frac{R_1}{n^2}} \qquad l_2 \quad \frac{l_1}{n}$$

- If the resistance of a conductor isR_1 and its diameter is incrased n times, then the resistance of the conductor (R_2)-

$$\because d_2 \quad nd_1$$

$$\boxed{R_2 \quad \frac{R_1}{n^4}} \qquad A_2 \quad n^2 A_1$$

$$\& \; l_2 \quad l_1 / n^2$$

- **Electrical power:** Electrical power is the rate at which work is done in an ectrical circuit. Its SI unit is watt. $P = \frac{W}{t}$

Where, P→ Power, W→Work done
t→ time in second

$$\boxed{P = VI = I^2R = \frac{V^2}{R}}$$

- The general unit of power is Joule/second.
- The industrial unit of electrical power is H.P.(Horse power)
- 1 kW= 1000W
- 1 H.P. (metric) = 735.5 Watt or Joule/second
- 1H.P. (British) = 746 watt or Joule/second.

Electrical Energy:

- The energy is generated by the movement of electrons from one point to another.
- The Joule or watt second is the fundamental unit of electrical energy.
- The SI unit of electrical energy is kWh.
- It is represented by 'E'.
- $E = VIt = I^2Rt = \frac{V^2}{R}t$
- 1 kWh = 3.6×10^6 Joule ● 1 kWh = 860 kilo calories

Joule's law of heating:

According to this law, when a current 'I' passes through a conductor of resistance 'R' for time 't' then the heat developed in the conductor is equal to the product of the square of the current, resistance and time.

$H \propto I^2$, $H \propto R$, $H \propto t$, $H \propto I^2Rt$

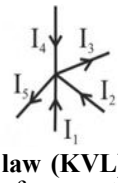
$$H = I^2Rt \text{ Joule} = \frac{I^2Rt}{4.18} \text{Calories}$$

- We see that power is simply the product of the voltage across an element and the current through the element.
- **Active and passive elements-** The element which is not capable for delivering energy, only capable to absorb the energy is called passive element.
- **Example-** Resistor, Inductor, diodes and capacitor.
- The element which is capable for delivering energy is called active element.
- **Example-** op-amps, generators and independent sources are the example of active elements.
- **Bilateral and unilateral elements-** For a bilateral element the voltage current relationship is the same for current flowing in either direction.
- Resistors, inductors and capacitors are the examples of bilateral elements.
- For a unilateral element the voltage-current relationship is different for two directions of current flow. Diode is an unilateral element.
- **Linear and non-linear-** The element that follows additivity and homogeneity property for relationship between excitation and response is called a linear element.
- The element that does not follow additivity and homogeneity property for relationship between excitation and response is called non-linear element.

Kirchhoff's law-

- **Kirchhoff's current law (KCL)-** "In any electrical network the algebraic sum of the currents meeting at a point (or junction) is zero." Kirchhoff's first law is based on the law of conservation of charge, which requires that the algebraic sum of charges with in a system cannot change.

$$\sum_{n=1}^{N} I_n = 0 \qquad I_1 + I_2 + I_4 = I_5 + I_3$$

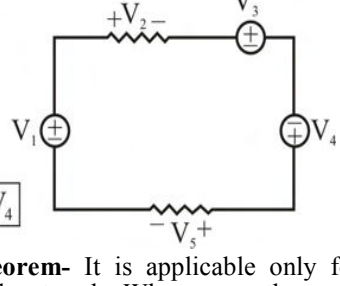


- **Kirchhoff's mesh law or voltage law (KVL)-** The algebraic sum of the products of currents and resistances in each of the conductors in any closed path (or mesh) in a network plus the algebraic sum of the emf in that path is zero.
- Kirchhoff's second law is based on the principle of conservation of energy.

$$\sum_{m=1}^{m} V_m = 0$$

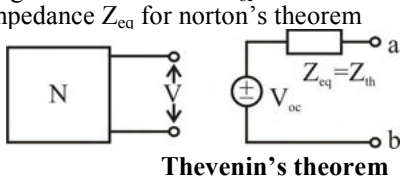
$$\sum V_{drop} = \sum V_{rise}$$

$$V_2 + V_3 + V_5 = V_1 + V_4$$



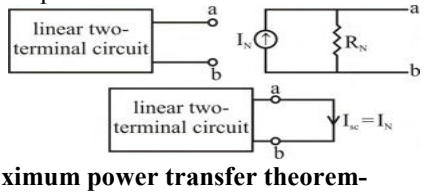
- **Superposition theorem-** It is applicable only for linear and bilateral network. When more than one independent voltage or current source is present, then response across any element in the circuit, is the sum of the responses obtained from each source.
- **Thevenin's theorem -** It states that any linear, bilateral and active RLC network which contains

one or more independent or dependent voltage or current source can be replaced by a single voltage source V_{oc} in series with equivalent impedance Z_{eq} for thevenin's theorem and can be replaced by a single current source I_{sc} in shunt with equivalent impedance Z_{eq} for norton's theorem

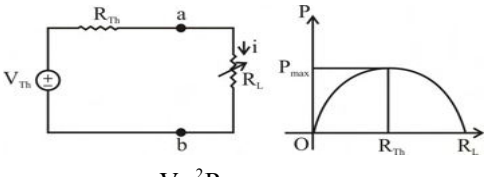


Thevenin's theorem

- **Norton's theorem-** Norton's theorem state that a linear two terminal circuit can be replaced by an equivalent circuit consisting of a current source I_N in parallel with a resistor R_N where I_N is the short-circuit current through the terminals and R_N is the input or equivalent resistance at the terminals when the independent sources are turned-off.



- **Maximum power transfer theorem-**
A resistive load will abstract maximum power from a network when the load resistance is equal to the resistance of the network as viewed from the output terminals, with all energy sources removed leaving behind their internal resistances.



$$P_L = I_L^2 R_L = \frac{V_{Th}^2 R_L}{(R_{Th}+R_L)^2}$$

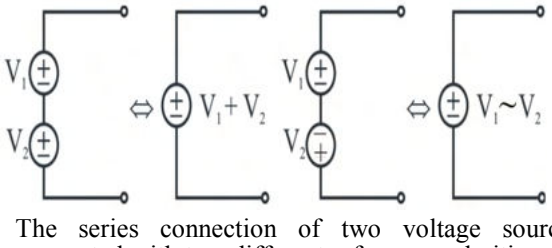
- According to this theorem R_L will abstract maximum power from the network when $R_L = R_{Th}$

$$\boxed{\text{Max Power is } P_{Lmax} = \frac{V_{Th}^2 R_L}{4R_L^2} = \frac{V_{Th}^2}{4R_L} = \frac{V_{Th}^2}{4R_{Th}}}$$

- **Source conversion-** In this section we will study the interconnection of Independent voltage and current source, four types of interconnection are possible.

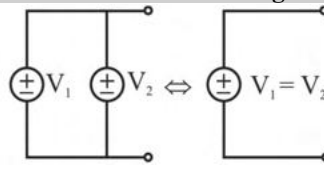
i. Series connection of voltage sources.
ii. Parallel connection of identical voltage sources.
iii. Parallel connection of current source.
iv. Series connection of identical current source.

Series connection of voltage sources-



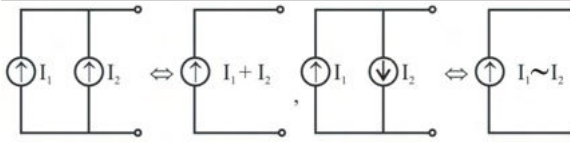
The series connection of two voltage sources connected with two different reference polarities and two same reference polarities.

Parallel connection of identical voltage source-



The parallel connection of two source have identical voltage. The unequal voltage source.

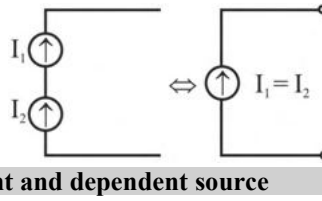
Parallel connection of current source-



Current source connected in parallel are equivalent to a single current source.

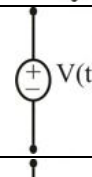
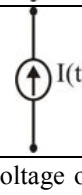
The current sources cannot be connected in series unless the two source have identical values.

Series connection of identical current source-

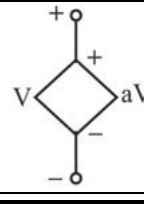


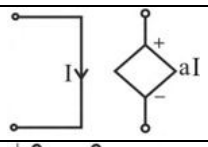
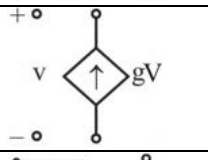
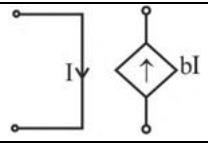
Independent and dependent source

- **Independent source:** Those voltage or current source which do not depend on any other quantity in the circuit are called independent source.

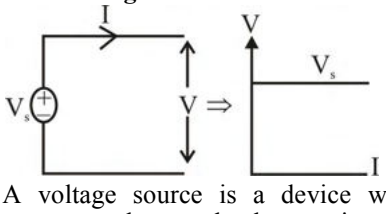
Independent time-invariant voltage source	
Independent time-variant voltage source	
Independent time-invariant current source	
Independent time-variant current source	

- **Dependent source:** A dependent voltage or current source is one which depends on some other quantity in the circuit which may be either a voltage or a current.

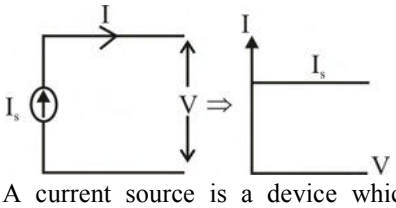
Voltage-dependent voltage source.	

Current dependent voltage source.	
Voltage dependent current source	
Current dependent current source.	

- **Ideal voltage source-**



- A voltage source is a device which provides a constant voltage to laod at any instant of time and is independent of the current drawn from it.
- It has zero internal rsistance.
- **Ideal current source-**



- A current source is a device which provides the constant current to the load at any time and is independent of the voltage supplied to the circuit
- It has infinite internal resistance.
- **Static electricity-** If somehow some electrons are removed from the atom of a body then it is left with a preponderance of positive charge. It is then said to be positively-charged. If on the other hand some electrons are added to it negative charge out-balances the positive charge and the body is said to be negatively charged.

  In brief we can say that positive electrification of a body results from a deficiency of the electrons whereas negative electrification results from an excess of electron.
- **Laws of Electrostatics**
- **First law-** Like charges of electricity repel each other whereas unlike charge attract each other.
- **Second law-** According to this law the force exerted between two point charge (i) is directly proportional to the product of their strengths (ii) is inversely proportional to the square of the distance between then. This law is known as coulomb's law and can be expressed mathematically as.

  $F \propto \frac{Q_1Q_2}{d^2}$ or $F = K\frac{Q_1Q_2}{d^2}$

  Where K is the constant of proportionality whose value depends on the system of unit employed In

S.I. system as well as M.K.S.A. system k = 1/4πε. Hence the above equation becomes.

$$F = \frac{Q_1Q_2}{4\pi\varepsilon d^2} = \frac{Q_1Q_2}{4\pi\varepsilon_0\varepsilon_r d^2}$$

If Q_1 and Q_2 are in coulomb, d in meter and ε in Farad/meter then F is in Newton.

Now

$$\frac{1}{4\pi\varepsilon_0} = \frac{1}{4\pi\times 8.854\times 10^{-12}}$$

$$= 8.9878\times 10^9 = 9\times 10^9 \text{ (approx)}$$

Hence, Coulomb's law can be written as

$$F = 9\times 10^9 \frac{Q_1Q_2}{\varepsilon_r d^2} \quad \text{in a medium}$$

$$= 9\times 10^9 \frac{Q_1Q_2}{d^2} \quad \text{in air or vacuum} \quad ...(i)$$

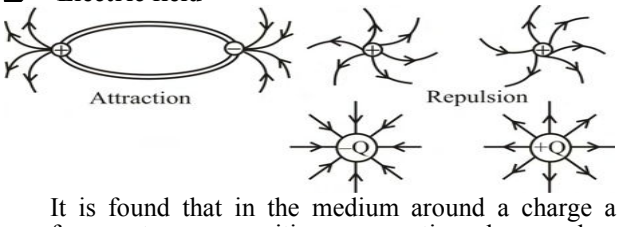
If in eq. (i) above,

$Q_1 = Q_2 = Q$(say)d = 1meter $F = 9\times 10^9$ N

$Q^2 = 1$ or Q = 1 coulomb

"That charge (or quantity or electricity) which when placed in air (strictly vacuum) from an equal and similar charge repels it with a force of 9×10^9 N."

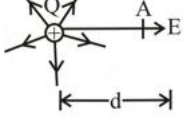
- **Electric field-**



It is found that in the medium around a charge a force acts on a positive or negative charge when placed in that medium. If the charge is sufficiently large. Then it may create such a huge stress as to cause the electrical rupture of the medium.

- Why unlike charge attract each other and try to come nearer to each other.
- Why like charge repel each other.
- It is more common to use the term lines of force. These lines are supposed to emanate from a positive charge and end on a negative charge.
- **Field strength or field intensity or electric intensity (E):** It is given by the force experienced by a unit positive charge placed at that point. Its direction is the direction along which the force acts.
- The unit of E is Newton/coulomb (N/C).
- If a charge of a coulombs placed at a particular point P within an electric field instances a force of network then electric field at that point is given by

$$E = \frac{F}{Q} \quad \text{N/C}$$



$$F = \frac{Q\times 1}{4\pi\varepsilon_o\varepsilon_r d^2} \text{ N}$$

$$\vec{F} = \frac{Q\times 1}{4\pi\varepsilon_o\varepsilon_r d_{PA}^2}$$

$$\left.\begin{aligned} F &= \frac{Q\times 1}{4\pi\varepsilon_o\varepsilon_r d_{PA}^2} \text{ N/C} \\ &= 9\times 10^9 \frac{Q}{\varepsilon_r d_{PA}^2} \text{ N/C} \end{aligned}\right\} \text{in a medium}$$

- Electric intensity at a point may by defined as equal to the lines of force passing normally through a unit cross-section at that point suppose there is a charge of Q coulombs. The number of normally on an area of A/m^2 surrounding the point the electric intensity at that point is

$$E = \frac{Q/E}{A} = \frac{Q}{\varepsilon A}, \qquad Q/A = D$$

$$E = \frac{D}{\varepsilon} = \frac{D}{\varepsilon_0 \varepsilon_r} \text{ (in a medium)} \quad = \frac{D}{\varepsilon_0} \text{(in air)}$$

The unit of E is volt/meter.

- Electric field intensity at any point is equal to the potential gradient at that point. In other words, E is equal to the rate of fall of potential in the direction of the lines of force.

$$\boxed{E = \frac{-dv}{dt}}$$

The unit of E is volt/meter.

$\because$ In vector notation $\boxed{\vec{D} = \varepsilon_o \vec{E}}$

- **Electric flux density or electric displacement:**

It is given by the normal flux per unit area. If a flux of ψ coulombs passes normally through an area of m^2, then flux density is

$$\boxed{D = \frac{\psi}{A}} \quad c/m^2$$

It is related to electric field intensity by the relation

$D = \varepsilon_o \varepsilon_r E = \varepsilon_o E$

In other words the product of electric intensity E at any point with in a dielectric medium and the absolute permittivity ($\varepsilon = \varepsilon_o \varepsilon_r$) at the same point is called the displacement at that point.

- **Potential and potential difference-**

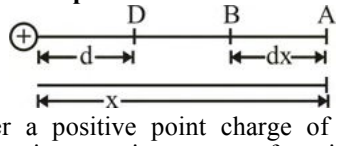
Numerically equal to the work done in bringing a positive charge of one coulomb from infinity to that point against the electric field. The unit of this potential will depend on the unit of charge taken and the work done.

If in shifting one coulomb from infinity to a certain point in the electric field. The work done is one joule. Then potential of that point is one volt.

$$1\,\text{Volt} = \frac{1\,\text{Joule}}{1\,\text{Coulomb}}$$

Similarly, potential difference of one volt exists between two points if one Joule of work done is shifting a charge of one coulomb form one point the other.

- **Potential at a point-**



Consider a positive point charge of Q coulombs placed in air at a point x meters from it the force on one coulomb positive charge is $Q/4\pi\varepsilon_o x^2$ suppose this one coulomb charge is moved towards Q through a small distance dx then work done is

$$dW = \frac{Q}{4\pi\varepsilon_o r^2} \times (-dx)$$

The negative sign is taken because dx is considered done the negative direction of x.

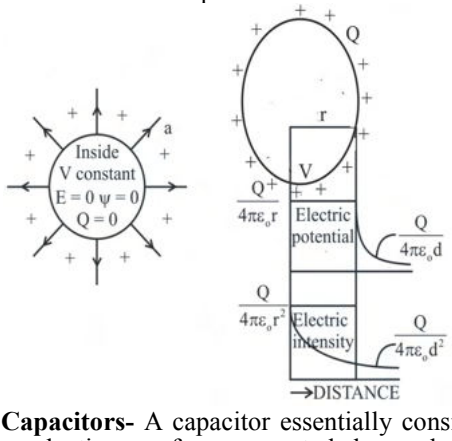
$$V = \frac{Q}{4\pi\varepsilon_o d} = 9\times10^9 \frac{Q}{d} \text{ volt}$$

$$V = \frac{Q}{4\pi\varepsilon_o\varepsilon_r d} = 9\times10^9 \frac{Q}{\varepsilon_r d} \text{ volt}$$

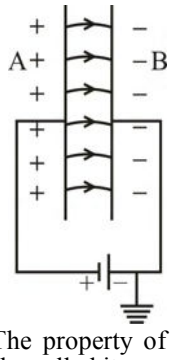
We find that as d increases V decreases till it becomes zero at infinity.

- **Equipotential surfaces.**

An equipotential surface is a surface in an electric field such that all points on it at the same potential.



- **Capacitors-** A capacitor essentially consists of two conduction surface separated by a layer of an insulating medium called dielectric.

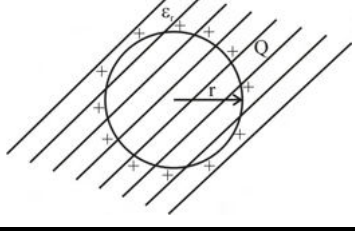


- **Capacitance-** The property of a capacitor to 'store electricity' may be called its capacitance.

Q coulomb of charge to one of the two plate of capacitor and if a paticial difference of V volts is established between two then its capacitance is

$$C = \frac{Q}{V} = \frac{\text{Charge}}{\text{Potential difference}}$$

- **Capacitance of an isolated sphere-** consider a charged sphere of radius r metres having a charge of Q coulomb placed in a medium a charge of Q coulomb placed in a medium or relative permittivity ε_r. The force surface potential V of such a sphere with respect to infinity.



$$V = \frac{Q}{4\pi\varepsilon_o\varepsilon_r r} \because \quad \frac{Q}{V} = 4\pi\varepsilon_o\varepsilon_r r$$

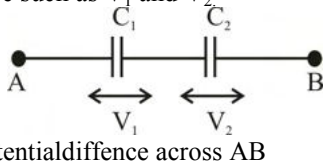
Q/V = Capacitance C

$= 4\pi\varepsilon_o\varepsilon_r r.$ (in a medium)

$= 4\pi\varepsilon_o r.$ (in air)

Series combination of capacitors-

When capacitors are connected in series, the magnitude of charge on each capacitor is the same. The poteial difference across C1 and C2 is difference such as V_1 and V_2.

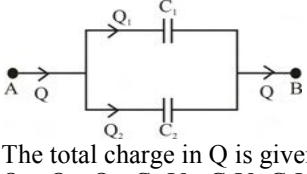


- Total potentialdiffence across AB

$$V = V_1 + V_2, \quad \frac{Q}{C_{eq}} = \frac{Q}{C_1} + \frac{Q}{C_2}, \quad \frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$$

Parallel combinationof capacitors-

When capacitors are connected in parallel the potential difference V across each is the same and the charge on C_1 and C_2 is different such as Q_1 and Q_2.

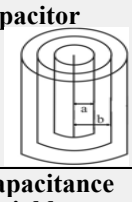


The total charge in Q is given as-

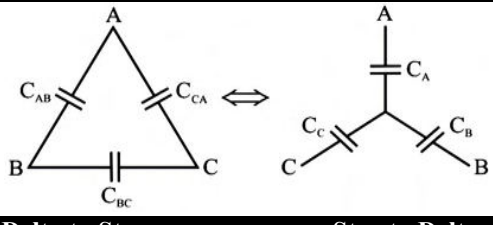
$Q = Q_1+Q_2$, $C_{eq}V = C_1V+C_2V$, $Ceq = C_1+C_2$

NOTE

Capacitance of Capacitor	$C = \frac{\varepsilon_o\varepsilon_r A}{d}$ Farad
Capacitance of different Dielectric having different thickness and relative permittivities	$C = \frac{\varepsilon_o A}{\frac{t_1}{\varepsilon_{r_1}} + \frac{t_2}{\varepsilon_{r_2}} + \frac{t_3}{\varepsilon_{r_3}}}$ Farad
When some part of parallel plate capacitor have air medium and some part have another medium then capacitance	$C = \frac{\varepsilon_o A}{\left[d - \left(t - \frac{t}{\varepsilon_r}\right)\right]}$ Farad
When some part of parallel plate capacitor have air medium in horizontal direction and some part have another medium then capacitance	$C = \frac{\varepsilon_o A}{d}\left[\frac{1+\varepsilon_r}{2}\right]$ $= C_{air}\left[\frac{1+\varepsilon_r}{2}\right]$ Farad

Capacitance of cylindrical capacitor 	$C = \frac{2\pi\varepsilon_o\varepsilon_r\ell}{\log_e b/a}$ Farad $C = \frac{2\pi\varepsilon_o\varepsilon_r\ell}{2.303\log_{10} b/a}$ Farad
Capacitance of variable capacitor	$C = \frac{(n-1)\varepsilon_o\varepsilon_r A}{d}$ Farad Where n = no. of plates

- **Conversion of Capacitors–**



Delta to Star	Star to Delta
$C_A = C_{AB} + C_{CA} + \frac{C_{AB}\,C_{CA}}{C_{BC}}$	$C_{AB} = \frac{C_A\,C_B}{C_A + C_B + C_C}$
$C_B = C_{AC} + C_{BC} + \frac{C_{AC}\,C_{BC}}{C_{AB}}$	$C_{BC} = \frac{C_B\,C_C}{C_A + C_B + C_C}$
$C_C = C_{BC} + C_{AB} + \frac{C_{BC}\,C_{AB}}{C_{AC}}$	$C_{CA} = \frac{C_C\,C_A}{C_A + C_B + C_C}$
For same value of capacitance- $\boxed{C_\Delta = \frac{1}{3}C_y}$	

Charging and Discharging of Capacitor

Charging	Discharging	Time constant for capacitor
Current equation $I_C(t) = I_0 e^{-t/\tau}$	Current equation $I_C(t) = -I_0 e^{-t/\tau}$	$\tau = R_{th}C_{eq}$
Voltage equation $V_C(t) = V_0\left(1 - e^{-t/\tau}\right)$	Voltage equation $V_C(t) = V_0\, e^{-t/\tau}$	
Charge equation $q_c(t) = Q_0\left(1 - e^{-t/\tau}\right)$	Charge equation $q_{c(t)} = Q_0\, e^{-t/\tau}$	

- **Transient Equation for Capacitor–**

$$\boxed{V_c(t) = V_c(\infty) + \left[V_c(0^+) - V_c(\infty)\right]e^{-t/\tau} t > 0}$$

- **Concept of short circuit and open circuit of capacitor with respect to time-**

$$i_c = \frac{CdV}{dt}; \qquad V_c(t) = \frac{1}{C}\int_0^t i_c(t)dt + V(0^-)$$

- **Behaviour of Capacitor -**

With initial condition	at $t = 0^+$ $\rightarrow$ act as a voltage source at $t = \infty$ $\rightarrow$ act as open circuit
without initial condition	at $t = 0$ $\rightarrow$ act as short circuit at $t = \infty$ $\rightarrow$ act as open circuit

- **Some important point Regarding to Capacitor–**

➲	Capacitor opposes rate of change of voltage. $V_C(0^-) = V_C(0^+)$
➲	Capacitor Stores the energy in electric field.
➲	While charging, $I_C(t) = \frac{CdV_C(t)}{dt}$ decreased and $I_C(t)$ must be positive.
➲	While discharge, $I_C(t) = \frac{CdV_C(t)}{dt}$ decreased but $I_C(t)$ must be negative
➲	While a capacitor charge and discharge polarity of dc voltage of capacitor never change.

- **Energy Stored in Capacitor –**

While charging a capacitor charges are transferred to the two plates of the capacitor. The work done on these charges is stored as electric potential energy, which is given by-

$$E = \frac{1}{2}CV^2 = \frac{1}{2}QV = \frac{1}{2}\frac{Q^2}{C} \text{ Joules}$$

- **Inductor:** An inductor is defined as a passive component that is used in most electrical circuit to store energy in the form of magnetic energy when electric current flows through it.

Faraday's law of electromagnetic induction-

First law	Change of magnetic flux linked to a coil induce an emf across a coil.
Second law	The emf induced across the coil is equal to rate of change of flux in the coil.

$$e = -N\frac{d\phi}{dt}$$

Where, negative sign shows that emf induced always oppose the change in flux.

Faraday's law for an inductor

$$V_L = L\frac{di}{dt} \qquad i(t) = \frac{1}{L}\int_0^t V_L dt + i(0^-)$$

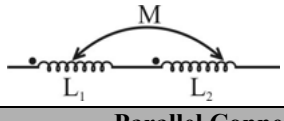
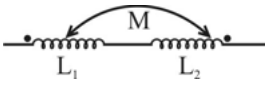
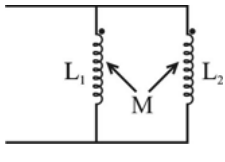
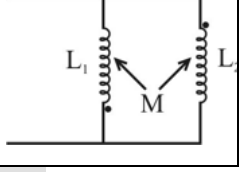
Types of inductance

Self inductance	$L = \frac{N\phi}{i} = \frac{V_L}{di/dt} = \frac{N^2}{S} = \frac{\mu_o\mu_r aN^2}{\ell}$ Where N = no. of turns in the coil, 'a' is cross sectional area and ℓ is the length of the coil. Also, μ_r = Relative permeability $\mu_0 = 4\pi \times 10^{-7}$ Henry/meter S = Reluctance
Mutual Inductance	$M = \frac{N_2\phi_1}{i_1} = \frac{V_{L_2}}{di_1/dt} = \frac{\mu_o\mu_r N_1 N_2 \pi r^2}{\ell_1}$ $M = \frac{\mu_o\mu_r N_1 N_2 A}{\ell_1}$
Coupling factor of Inductance	$K = \frac{M}{\sqrt{L_1 L_2}}$

Behaviour of Inductor

Inductor with initial condition	at $t = 0^+ \rightarrow$ act as a current source at $t = \infty \rightarrow$ act as short circuit
Inductor without initial condition	at $t = 0 \rightarrow$ act as an open circuit at $t = \infty \rightarrow$ act as short circuit

- **Energy stored in inductor-** $\boxed{E = \frac{1}{2}Li^2}$
- **Magnetic Coupling of Inductor**

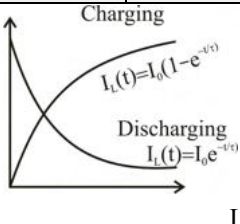
Series Connection of Inductor	
i. Aiding nature $L = L_1 + L_2 + 2M$ 	**ii. Opposing nature** $L = L_1 + L_2 - 2M$ 
Parallel Connection of Inductor	
i. Aiding nature $L_{eq} = \frac{L_1L_2 - M^2}{L_1 + L_2 - 2M}$ 	**ii. Opposing nature** $L_{eq} = \frac{L_1L_2 - M^2}{L_1 + L_2 + 2M}$ 

- **Transient Equation for Inductor**

$$\boxed{i_L(t) = i_L(\infty) + \left[i_L(0^+) - i_L(\infty)\right]e^{-t/\tau} \quad t > 0}$$

- **Charging and Discharging of Inductor**

Charging	Discharging
Current $I_L(t) = I_o\left(1 - e^{-t/\tau}\right)$	Current $I_L(t) = I_o e^{-t/\tau}$
Voltage $V_L(t) = V_o e^{-t/\tau}$	Voltage $V_L(t) = -V_o e^{-t/\tau}$



- **Time constant for inductor** $\tau = \frac{L}{R}$ second

- **Behaviour of Inductor**

➲	Inductor is linear, bilateral and passive element.
➲	Inductor opposes the sudden change of current. $I_L(0^-) = I_L(0^+)$
➲	Inductor allows the sudden change of voltage.
➲	Inductor is an energy storing element.
➲	Inductor does not dissipate any power, it only stores energy.

❒ Analysis of Coupled Circuits

◘ Similarities

Electric Circuit	Magnetic Circuit
The closed path for electric current is called an electric circuit.	The closed path for magnetic flux is called a magnetic circuit.
Exciting force = Voltage/EMF [Units : Volts]	MMF → Magnetomotive force → MMF = N.I Units: Ampere-turns (AT)
Response = 'Current' (I) [units: Ampere (A)]	Response = 'Flux' [units : webers (Wb)]
Ohms Law: $R = \frac{V}{I}$, where, R = Resistance; [unit : Ω]	Ohms Law: $S = \frac{MMF}{\phi} = \frac{NI}{\phi}$ Where, S = Reluctance, $\left[\text{unit} = \frac{AT}{Wb}\right]$
In electrical material $R = \frac{\rho \ell}{a}$	In magnetic material $S = \frac{\ell}{\mu a}$
Electric field intensity: $E = \frac{V}{d}$ [unit: volt/m]	Magnetic Field intensity: $H = \frac{MMF}{\ell} = \frac{NI}{\ell}; \left[\text{Unit} : \frac{AT}{m}\right]$
Electric Current Density: $J = \frac{I}{a}; \left[\text{Unit} : \frac{A}{m^2}\right]$	Magnetic Flux Density $B = \frac{\phi}{a}; \left[\text{unit} : \frac{Wb}{m^2} (\text{or}) \text{Tesla} (T)\right]$
$J = \sigma E$ (J = Electric current density) (σ = Conductivity)	$B = \mu H$ (B = Magnetic flux density) $\mu = \mu_0 \mu_r$
In series, $R_s = R_1 + R_2$, In parallel, $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$	In series, $S_s = S_1 + S_2$, In parallel, $\frac{1}{S_P} = \frac{1}{S_1} + \frac{1}{S_2}$

- **Dissimilarities**

Magnetic flux does not flow.	The electric current actually flows in an electric circuit.
There is no magnetic insulator. For example, flux can be set up even in air (the best known magnetic insulator) with reasonable m.m.f.	There are a number of electric insulators. For instance, air is a very good insulator and current can not pass through it.

❑ AC Circuit Analysis

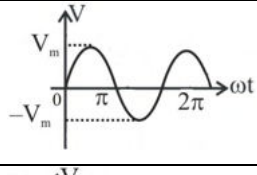
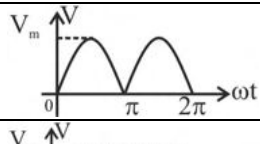
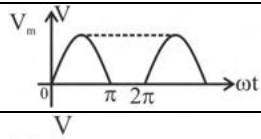
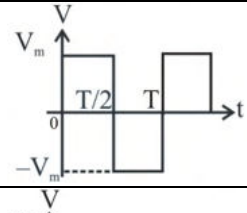
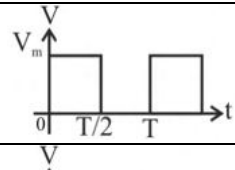
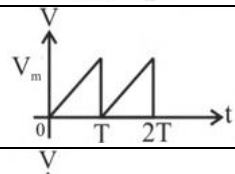
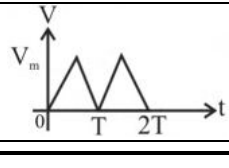
- **Average and RMS value of periodic signals**

Average value = DC value	$V_{avg} = V_{DC} = \frac{1}{T}\int_0^T V(t)dt$ • Any function whose cycle is repeated continuously. • Symmetrical AC signal, average value equal to zero.
RMS value	$V_{rms} = \sqrt{\frac{1}{T}\int_0^T V^2(t)dt}$ If $f(t) = a_0 + a_1 \cos\omega t + a_2 \cos 2\omega t + ... + b_1 \sin$ $f(t)_{RMS} = \sqrt{a_0^2 + \frac{1}{2}\left(a_1^2 + a_2^2 + ... + b_1^2\right)}$

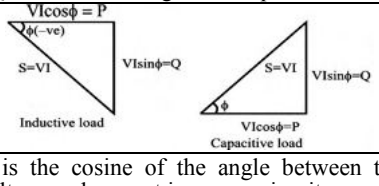
Some factor of AC signal

Peak factor	$P.F. = \frac{V_{max}}{V_{rms}}$
Form factor	$F.F. = \frac{V_{rms}}{V_{avg}}$

- **RMS and Average of Signal**

Time domain Signal	RMS value	Average Value
	$V_{rms} = \frac{V_m}{\sqrt{2}}$	$V_{avg} = \frac{2V_m}{\pi}$
	$V_{rms} = \frac{V_m}{\sqrt{2}}$	$V_{avg} = \frac{2V_m}{\pi}$
	$V_{rms} = \frac{V_m}{2}$	$V_{avg} = \frac{V_m}{\pi}$
	$V_{rms} = V_m$	$V_{avg} = V_m$
	$V_{rms} = \frac{V_m}{\sqrt{2}}$	$V_{avg} = \frac{V_m}{2}$
	$V_{rms} = \frac{V_m}{\sqrt{3}}$	$V_{avg} = \frac{V_m}{2}$
	$V_{rms} = \frac{V_m}{\sqrt{3}}$	$V_{avg} = \frac{V_m}{2}$

❑ Power in AC Sinusoidal Signal

Instantaneous power	**$P = V_{rms}I_{rms}\cos\phi$** $= \frac{1}{2}V_m I_m \cos\phi$ In a purely resistive circuit $\phi = 0$ In a pure capacitive circuit $\phi = 90°$(lead) In a pure inductive circuit $\phi = 90°$ (lag)
Apparent power	S = VI unit = VA
Reactive power	Q = VIsinϕ unit = VAR other name- Wattless power, Quadrature power
Complex power	S = VI* = P ± jQ +Q indicates lagging reactive power, –Q indicates leading reactive power.
Power triangle	
Power factor	It is the cosine of the angle between the voltage and current in any ac circuit. $\cos\phi = \frac{R}{Z}$ or $\text{Cos}\phi = \frac{P}{S} = \frac{\text{Watt}}{\text{VA}}$

❑ Single Phase AC Circuit

- **Series circuit**

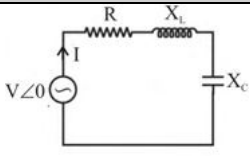
RL	RC	RLC
$V_{RL} = \sqrt{V_R^2 + V_L^2}$ $V_R = IR$ $V_L = IX_L\angle 90^0$ $Z = R + jX_L$	$V_{RC} = \sqrt{V_R^2 + V_C^2}$ $V_R = IR$ $V_C = IX_C\angle -90^0$ $Z = R - jX_C$	$V = \sqrt{V_R^2 + (V_L - V_C)^2}$ $Z = R + j(X_L - X_C)$
$\phi = \tan^{-1}\frac{V_L}{V_R}$	$\phi = \tan^{-1}\left(\frac{-V_C}{V_R}\right)$ $= \tan^{-1}\frac{-X_C}{R}$	$\phi = \tan^{-1}\frac{V_L - V_C}{V_R}$ $\phi = \tan^{-1}\left(\frac{Q_L - Q_C}{P}\right)$
$\cos\phi = \frac{V_R}{V}$(lag)	$\cos\phi = \frac{V_R}{V}$ (lead)	$\cos\phi = \frac{V_R}{V}$ If $V_L > V_C$(lag) $V_C > V_L$(lead) If $V_L = V_C$ (Resonance) $\cos\phi = 1$

- **Parallel Circuit-**

RL	RC	RLC
$I = \sqrt{I_R^2 + I_L^2}$ $I_R = \frac{V}{R}, I_L = \frac{V}{X_L}\angle -90^0$	$I = \sqrt{I_R^2 + I_C^2}$ $I_C = \frac{V}{X_C}\angle 90^0$	$I = \sqrt{I_R^2 + (I_C - I_L)^2}$ $Y = G + j(B_C - B_L)$
$\cos\phi = \frac{I_R}{I}$ (lag) $\cos\phi = \frac{G}{Y}$	$\cos\phi = \frac{I_R}{I}$ (lead)	$\cos\phi = \frac{I_R}{I}$ (Lead); $I_C > I_L$ (Lag); $I_L > I_C$ $\cos\phi = 1$; $I_L = I_C$

❑ Resonance Circuit

Series Resonance Circuit



- **Resonance Condition** $X_C = X_L$, $|V_L| = |V_C|$
- **Resonance current**

  $\uparrow I = \frac{V}{R} = \frac{V}{Z\downarrow} = \text{maximum}$
- **Resonance impedance**

  $Z = R = \text{minimum}$, $Y = \text{maximum}$
- **Resonance Frequency**

  $\omega_o = \frac{1}{\sqrt{LC}} \text{rad/sec}$ $f_0 = \frac{1}{2\pi\sqrt{LC}} \text{Hz}$
- **Band Width**

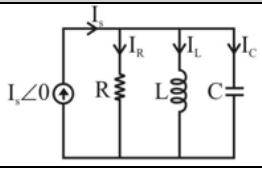
  $\Delta\omega = B.W = \frac{R}{L} = \omega_2 - \omega_1 = \frac{\omega_0}{Q}$

  $\omega_2 = \omega_o + \frac{\Delta\omega}{2}$, $\omega_1 = \omega_o - \frac{\Delta\omega}{2}$
- **Quality factor**

  $Q = \frac{|V_L|}{V} = \frac{|V_C|}{V} = \frac{X_L}{R} = \frac{X_C}{R} = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{\omega_o L}{R} = \frac{1}{\omega_0 CR}$
- **Properties**
- Net reactive power of a series resonant circuit is ze
  $|P_{LC}| = 0$
- It is also called accepter circuit.
- Net reactive voltage of series resonant circuit is ze
  $|V_{LC}| = 0$
- Series resonance circuit is voltage magnifier circuit.
- Quality factor $\propto \frac{1}{\text{power factor}} \propto \frac{1}{B.W}$
- **Series RL parallel C circuit**

  $\omega_0 = \sqrt{\frac{1}{LC} - \left(\frac{R}{L}\right)^2}$
- **Series RL with parallel RC series circuit**

  $\omega = \frac{1}{\sqrt{LC}}\sqrt{\frac{R_L^2 - \frac{L}{C}}{R_C^2 - \frac{L}{C}}}$ rad/sec
- Dynamic impedance $Z = \frac{L}{CR}$
- Quality Factor (Q.F.) = $\frac{1}{R}\sqrt{\frac{L}{C}}$

	Parallel Resonance circuit
	
	• **Resonance condition** $\lvert I_L\rvert = \lvert I_C\rvert$
	• **Resonance current** • $\downarrow I_s = \frac{V}{R} = \frac{V}{Z\uparrow} = I_R$ = minimum • **Resonance impedance** $Z = \frac{L}{RC}$ maximum, Y = minimum
	• **Resonance Frequency** $f_0 = \frac{1}{2\pi\sqrt{LC}}$ Hz
	• **Band Width** $B.W = \omega_2 - \omega_1 = \frac{1}{RC} = \frac{\omega_0}{\omega_0 RC} = \frac{\omega_0}{Q}$ $\omega_1 = \omega_0 - \frac{\Delta\omega}{2}, \quad \omega_2 = \omega_0 + \frac{\Delta\omega}{2}$
	• **Quality factor** $Q.F. = 2\pi\left(\frac{\text{Maximum energy stored in the circuit}}{\text{Total energy dissipated by the circuit}}\right)$ $Q = \frac{R}{X_L} = \frac{R}{X_C} = \omega_0 CR = R\sqrt{\frac{C}{L}} = \frac{\lvert I_L\rvert}{I} = \frac{\lvert I_C\rvert}{I} = \frac{\omega_0}{B.W}$
ro. ro.	• **Properties** • It is current magnifier circuit. • It is also called rejecter circuit • At resonance $Z = \frac{L}{CR}$ (dynamic impedance) • circuit becomes purely resistive circuit • A parallel resonance circuit behave as - band stop filter
	• **Selectivity** $= \frac{\text{Resonance frequency}}{\text{Bandwidth}}$

❑ Three Phase System

In star connection	In Delta Connection
$i_R + i_Y + i_B = 0$; $I_L = I_{Ph}$ $V_L = \sqrt{3}V_{Ph}$; $V_{Ph} = \frac{V_L}{\sqrt{3}}$	$V_R + V_Y + V_B = 0$ $V_L = V_{Ph}$ $I_L = \sqrt{3}\, I_{Ph}$
$P = 3V_{Ph}I_{Ph}\cos\phi$ or $P = \sqrt{3}\, V_L I_L \cos\phi$ • Line voltage are 30^0 leading from the corresponding phase voltage.	$P = \sqrt{3}V_L I_L \cos\phi$ • Line currents are lagging by 30^0 from their corresponding phase currents.

- **Metal and Melting Point (in ^{0}C)**

Metal	Melting point (in °C)	Metal	Melting point (in °C)
Copper	1084	**Chromium**	1907
Magnesium	650	**Molybdenum**	2622
Zinc	419.5	**Tungsten**	3410
Aluminium	658.6	**Iron**	1538
Tin	231.8	**Cobalt**	1490
Lead	327.4	**Nickel**	1452
Silver	961	**Carbon**	3550

EXAM POINTS

- The element which is capable of delivering energy by its own is known as– **Active element**
- Potential Difference is– **Scalar Quantity**
- In power control circuit the resistor used are– **Wire wound resistor**
- Unit of power is – **Watt**
- The rate of doing work is called – **Power**
- Neutral is a circuit conductor that normally carries .....back to the source- **Current**
- Electron volt is the unit of – **Energy**
- The C.G.S. unit of heat is– **Calorie**
- 1 newton is the same as– **10^5 dynes**
- One B.O.T. unit is – **1 kWh**
- SI symbol given by SI system for thermodynamic temperature– **K**
- If the efficiency of a machine is to be high, what should be low– **Losses**
- One newton meter is same as – **One joule**
- The S.I. unit of electrical energy is – **Joule**
- Erg' is a unit of measurement for – **Energy**
- One unit of electrical energy equals – **1 KWh**
- Insulation resistance is expressed by – **Mega ohm**
- Conduct the electricity easily – **Sea water**
- Production of heat due to current is related by which law– **Joule's law**
- For testing appliances, the wattage of test lamp should be– **High**
- Ampere-hour is the unit of– **Energy**
- A lag network for compensation normally consist of– **R and C elements**
- Constant voltage source is – **Active and unilateral**
- A network which contains one or more than one source of emf is known as **–** **Active network**
- A passive network is one which contains – **No source of e.m.f. in it**
- The internal voltage drop in an ideal constant-voltage source– **0 (Zero)**
- A primary characteristic of an ideal voltage source – **It has zero internal resistance**
- In DC circuit, which components is used to reduce the voltage– **Resistor**
- Dependent sources are also called – **Controlled sources**
- Active elements in electrical network – **Current source, voltage sources and generators**

- Which is a passive element to an electrical circuit– **Resistor, inductor, capacitor**
- A point where two or more than two branches connect is called as– **Node**
- If there are "n" nodes in the circuit there will be ------- independent to nodal equation– **n-1**
- The average value of the current is the ------- divided by the number of currents- **Sum of all currents**
- In a close loop, the sum of voltage drops across components is equal to- **The applied voltage**
- Which law's is applied for mesh analysis of the network- **Kirchhoff's voltage law**
- The algebraic sum of the electric currents meeting at a junction point is– **Zero**
- Which law is based on the principle of conservation of electric charge– **Kirchhoff's current law**
- Algebraic sum of all currents meeting at a point is zero. Stated law is – **Kirchhoff's first rule**
- The nodal method of circuit analysis is based on – **KCL and Ohms law**
- Mesh analysis is based on – **Kirchhoff's Voltage law**
- For large networks generally – **The node analysis is preferred**
- The laws used in cutsets and tiesets of a network are– **Kirchoff's laws**
- Kirchoff's law is applicable to – **A.C. networks, D.C. networks**
- Kirchhoff's second law is based on law of conservation of – **Energy**
- Kirchoff's Voltage Law is known as – **Energy Conservation**
- Kirchoff's current law at a junction deals with– **Conservation of charge**
- Kirchoff's voltage law is concerned with– **IR drop, Battery e.m.f.**
- Kirchhoff's voltage laws are NOT applicable to circuits with – **Distributed parameters**
- The branch current method uses ----- **Kirchhoff's current law**
- Thevenin's theorem is form of an equivalent circuit **–Voltage**
- Closed circuit technique are based on – **Thevenins theorem**
- In the analysis of a vacuum tube circuit, we generally use Theorem – **Thevenin's**
- While Thevenizing a circuit between two terminals, V_{TH} is equal to – **Open-circuit terminal voltage**
- Norton's equivalent is **-Parallel Ckt**
- Which theorem is the converse of Thevenins theorem – **Norton's theorem**
- Norton's Theorem results in – **A Current source with an impedance in Parallel**
- Which theorem is also regarded as Dual of Thevenin's Theorem **-** **Norton's Theorem**
- Superposition theorem is applicable to – **Linear bilateral network**
- A non–linear network does not satisfy – **Both homogeneity as well as superposition condition**

- The Superposition Theorem is applicable to – **Current, voltage**
- To neglect a voltage source, the terminals across the source are– **Short-circuited**
- A linear element satisfies the properties of – **Superposition and Homogeneity**
- Superposition theorem is used to obtain current or voltage across any conductor of the – **Linear network**
- -------- is applicable to both linear and non linear circuits- **Substitution theorem**
- Superposition theorem is applicable for – **Linear network**
- Superposition theorem is only applicable for determining _____ only– **Voltage and current**
- When a source is delivering maximum power to the load; the efficiency will be - **50%**
- The maximum power is delivered from a source to a load when the source resistance is – **Equal to load resistance**
- Which expression is the expressed of maximum power theorem – $P_{max} = \frac{V_{Th}^2}{4R_L}$
- It is not desired to attain the condition of maximum power transfer – **Electric circuits**
- The theorem which states that in any linear nonlinear, passive, active, time-variant and time-invariant network, the summation of instantaneous powers is zero will be called as– **Tellegen's theorem**
- The maximum power transfer theorem can be applied to - **Both AC and DC circuits**
- Tellegen's theorem is based on the principle of law of – **Conservation of energy**
- Which is the direct method of network analysis - **Reciprocity theorem**
- The reciprocity theorem is applicable for– **Only single source network**
- The quantity that contains all the power information in a given load is– **Complex power**
- The reciprocal of reactance called is– **Susceptance**
- A coil with a certain number of turns has a specified time constant. If the number of turns is doubled, its time consant would– **Fourth time**
- A current is said to be direct current when its– **Magnitude remains constant with time**
- The rated voltage of a 3-phase power system is given as– **rms line-to-line voltage**
- Amount of light produced by a lamp or the amount of heat produced by an iron is proportional to the– **Square of RMS value**
- Advantage of active filter is– **Easy to tune**
- The formula for reactive power in a 3–phase system– $\sqrt{3}\, V_L I_L \sin\phi$
- Three phase balanced load means, all the three phase has– **Equal power factor and phase current**
- What frequency will be the fourth harmonic of 12 MHz– **48 MHz**
- In a balanced star connected system– **Line voltage are 120^0 apart**
- A choke is preferred to a resistance for limiting current in an a.c. circuit because– **There is no wastage of energy**

- Radio frequency choke is– **Air-cored**
- For greater accuracy, the value of ϕ (i.e. phase angle) should be determined from– **tan ϕ**
- If the lagging reactive power of an a.c. circuit increases, the power factor of the circuit– **Is decreased**
- Reactive power in an a.c. circuit is– **A liability on the circuit**
- A low power factor of the circuit means that it will– **Draw more reactive power**
- In a circuit element, the p.d. is higher than the applied voltage of the source. That will be– **An a.c. circuit**
- Wattless current is said to flow when phase angle between voltage and current is– **90°**
- The phasor $8\angle 60^o$ is identical to– **$8\angle 780^o$**
- For addition or subtraction of phasors, we use ..... form– **Rectangular**
- Identify the wave form shown in the figure below- **Pulse wave**
- The ratio of real power to apparent power of a load is : **cosϕ (Power Factor)**
- The cosine of the angle between voltage and current in an AC circuit is known as: **Power factor**
- For a sinusoidal waveform, the RMS value of current will be ……times the maximum value of current. **0.707**
- Associated with current-time graph given here is- **Alternating current**
- Which factor have value of 1.1 for sinusoidal alternating current only - **Form factor**
- The integration and derivative of a sinusoidal function of AC is - **Sinusoidal function**
- The values of an alternating voltage or current represent the real magnitude– **R.M.S value**
- The total opposition offered to the flow of current in A.C. circuit is called– **Impedance**
- At resonance frequency, the inductive reactance value is the same as– **Reactance of the capacitor**
- RMS value is defined based on– Heating effect
- In AC parallel circuit, the angle between voltage and current of each branch will by- **Different**
- The frequency of an alternating quantity is– **The number of cycles completed per second**
- The average power of an AC circuit- **VI cosϕ**
- For an alternating voltage or current, one cycle is equal to– **Two alternation**
- The crest value of an alternating quantity is equal to its- **Maximum value**
- The average value and the R.M.S value are equal for- **Square wave**
- For an alternating voltage or current one alternation is equal to - **One half cycle**
- The frequency of Direct current source is- **Zero**
- The ratio of the peak value of a wave to its RMS value is defined as - **Peak Factor**
- The average of all the instantaneous values of a sinusoidal quantity over a cycle is– **Zero**
- The period of a wave is– **Time required to complete one cycle**
- The voltage of domestic supply is 220 V. This figure represents– **R.M.S. value**

- For the same peak value which wave will have the highest r.m.s. value– **Square wave**
- For the same peak value, which wave has the least mean value– **Half wave rectified sine wave**
- The best place to install a capacitor is– **Across the terminals of the inductive load**
- Capacitors for power factor correction are rated in– **kVAR**
- Inductance effects the direct current flow– **At the time of turning ON and OFF**
- All the rules and laws of D.C. circuit also apply to A.C. circuit containing– **Resistance only**
- Power factor of the which circuit will be zero– **Pure Inductance, pure capacitance**
- Power factor of the which circuit will be unity– **Resistance**
- In the case of an unsymmetrical alternating current the average value must always be taken over– **The whole cycle**
- Inductance of coil– **Is affected by the supply frequency**
- In any A.C. circuit always– **Apparent power is more than actual power**
- In an A.C. circuit, a low value of kVAR compared with kW indicates– **High power factor**
- For the full wave rectified sine wave the r.m.s. value is– **0.707 I_{max}**
- Which waves has the highest value of peak factor– **Half wave rectified sine wave**
- The r.m.s. value of pure cosine function is– **0.707 of peak value**
- Which is true for apparent power in an A.C. circuit– **$V_{r.m.s.} \times I_{r.m.s.}$**
- The phasors for which pair are 180° out of phase for V_L, V_C and V_R– **V_C and V_L**
- The values of an alternating current is indicated by a normal universal measuring instrument– **$I_{r.m.s.}$**
- The power factor of a D.C. circuit is always– **Unity**
- The product of apparent power and cosine of the phase angle between circuit voltage and current is– **True power**
- The equation of 50 Hz current sine wave having r.m.s. value of 60 A is– **84.84 sin 314 t**
- The unit of frequency of an A.C. signal is– **Hertz**
- Which values of alternating voltage should an insulation absolutely withstand– **The peak value**
- In a pure inductive circuit if the supply frequency is reduced to 1/2, the current will be– **Doubled**
- In a pure capacitive Circuit if the supply frequency is reduced to 1/2, the current will be – **reduced by half**
- In an A.C. circuit I sin ϕ is called– **Wattless component**
- In A.C. circuit the power curve is a sine wave having– **Double the frequency of voltage**
- The value of operator j^2 is equal to– **–1**
- The ability of a resonant circuit to discriminate between one particular frequency and all others is called its– **Selectivity**
- A capacitor with no initial charge at $t = \infty$ acts– **Open-circuit**
- To neglect a current source, the terminals across the source are– **Open-circuited**

- A current is said to be alternating when it changes in– **Both magnitude and direction**
- The rms value of a half wave rectified symmetrical square wave current of 2 A is– $\sqrt{2}$**A**
- Change in circuit voltage will affect– **Current**
- The reactive power is also called as ..... power and it expressed in ..... **Imaginary, VAR**
- 1 Cycle = ... **2π radian**
- The average value of a symmetrical AC waveform is determined from the ..... of the waveform– **Half cycle**
- The length of the phasor represents the ..... of the sinusoidal– **Amplitude**
- The phasor rotates in..... **Anti Clockwise direction**
- ..... is the rate of change of ωt with respect to time– **Angular velocity**
- The relationship between the frequency of ac wave and the time period is given by– $f = \frac{1}{T}$
- VI cos ϕ is same as– I^2R
- Unit of apparent power is– **kVA**
- In a star connected 3 phase system– $\text{Phase voltage} = \frac{\text{line voltage}}{\sqrt{3}}$
- The efficiency of single phase system for same output is– **Less than three phase**
- The maximum value of power factor in an A.C. circuit is– **1**
- While drawing the phasor diagram of a parallel circuit, which one is taken as the reference– **Voltage**
- What is represented by the hypotenuse of impedance triangle– **Impedance drop**
- What is the effect of low power factor in the electrical system– **Current will be increased**
- Amplitude factor of the sinusoidal AC is– **1.414**
- Total opposition offered by R–L series circuit is called– **Impedance**
- The unit of inductive reactance is– **Ohm**
- The cause with low power factor is– **More inductive load**
- In a parallel ac circuit, power loss is due to only– **Conductance alone**
- The electrical degrees in between the phase of a 3 phase system is– **120°**
- The r.m.s. value of sinusoidally varying current is ..... that of its average value– **More than**
- Alternating voltages and currents are expressed in r.m.s. values because– **They give comparison with d.c.**
- Real part of admittance is– **Conductance**
- The inductive reactance of an inductor in a dc circuit in ohm is– **Zero**
- The maximum value, positive or negative, of an alternative quantity is known as– **Amplitude**
- The phasor form of capacitive reactance is– $X_c\angle -90^0$
- The two possible phase sequence are– **R–Y–B, R–B–Y**

- The main difference between scalar and vector quantity is– **Vector has magnitude and direction whereas scalar has only magnitude.**
- The form factor of dc voltage is– **Unity**
- The a.c. system is preferred to d.c. system because– **AC Voltages can be easily changed in magnitude**
- In a.c. system, we generate sine wave form because– **It produces least disturbance in electrical circuits**
- A wattmeter indicates ..... power– **Active**
- The difference between the half-power frequencies is called the– **Bandwidth**
- A power triangle can provide information about– **Power factor, kW, kVA, kVAR**
- For multiplication or division of phasors, we use ..... form– **Polar**
- The a.c. power in a load that is conserved is– **Real, reactive, apparent**
- Domestic appliances are connected in parallel across a.c. mains because– **Operation of each appliance becomes independent of the other**
- If the admittance of a parallel a.c. circuit is increased, the circuit current– **Is increased**
- The conductance and susceptance components of admittance are– **Parallel elements**
- Nature of power factor is determined by– **Position of current with respect to voltage**
- In a circuit containing R, L and C power loss can take place in– **R only**
- Who invented the alternating current– **Tesla**
- The unit of frequency of an AC signal is– **Hertz**
- What is the average value of a DC voltage having a peak value of 25 V– **25 V**
- When the phase sequence of supply currents are reversed, then the direction of rotation of the resultant magnetic field wave– **Reversed**
- Which wave will have the highest RMS value for equal peak values– **Square**
- .....is defined as the no. of cycle completed by an alternating quantity in one second– **Frequency**
- Which is the correct definition of phasor– **A line which represents the magnitude and phase of an alternating quantity**
- Which is the most common waveform of AC signal– **Sinusoidal**
- RMS value of sinusoidal current is given by– $\frac{1}{\sqrt{2}}$ **Times maximum value of current**
- The RMS value of a sine wave having peak value V_m over one cycle is– $\frac{V_m}{\sqrt{2}}$
- A standard sinusoidal current wave changes its polarity at– **Zero value**
- When two quantities are in quadrilateral then there will phase angle between them..... **90°**
- A voltage is said to be alternating when it changes in– **Both magnitude and direction**
- The unit of reactive power is given as– **Volt Ampere reactive (VAR)**

- Which quantity is preferred as a reference vector to draw a Phasor diagram in a series circuit– **Current**
- The transient currents are due to–**Changes in stored energy in inductors and capacitance**
- The reciprocal of impedance is called– **Admittance**
- Which input yields natural response– **Impulse input**
- If AC voltage represented as $V(t) = 10\cos(10\pi t)$ then form factor is– **1.11**
- The average power delivered to any network composed of ideal inductors and capacitors is– **Zero**
- The imaginary part of admittance is called– **Susceptance**
- Power factor of an AC circuit lies between– **0 to 1**
- The phenomenon of resonance is used in– **Radio**
- A passive element in a circuit is one which– **Recieves energy**
- The ideal value of power factor is– **1**
- The voltage of domestic supply is 220 Volt ac This represents– **RMS value**
- The average power of an A.C. circuit is– **VI cosϕ**
- Wattless current is possible only in– **A non resistive circuit**
- The value normally stated when referring to alternating currents and voltages is the– **R.M.S. value**
- The period of a sinusoidal wave is– **Time taken to complete one cycle**
- A Q meter measures– **Properties of the coils**
- The type of power in ac circuit is measured in volt-ampere (VA)– **Apparent power**
- It is defined as the product of the voltage and current with conjugate– **Complex power**
- Phasor quantities have– **Amplitude and direction both variable**
- $\sqrt{\frac{L}{C}}$ has its units as– **Ohm**
- The frequency of a signal is inversely proportional to– **Time period**
- The power of a single phase AC circuit is given by– **VI cos ϕ**
- ..... will not always produce any transients- **Pure resistive circuit**
- If the energy is dissipated, then the electric circuit is a - **Pure resistor**
- In a purely resistive circuit, the average power P_{av} is .....the peak power P_{max}– **One-half**
- There are no transients in pure resistive circuits because they– **Have no stored energy**
- Average power is purely resistive ac circuit is equal to P- **VI**
- The lamp load is an example of ..... load– **Purely resistive**
- In a particular circuit, $I_m \sin(\omega t–270)$ & $V = V_m \sin(\omega t+90)$. Then type of circuit is– **Pure resistive circuit**
- The current in circuit is wattless if– **Resistance in the circuit is zero**
- At very high frequencies, the parallel RL circuit behave as– **A pure resistive circuit**
- In purely resistive circuits, the__and the_ applied in phase with each other– **Current, voltage,**

- Power Factor of the…….circuit will be unity– **Resistance**
- The shunt element of prototype high pass filter is– **Inductive**
- Mutual inductance is measured in - **Henry**
- -------- is defined as weber turns in one coil due to one ampere current in the other- **Coefficient of mutual inductance**
- In active filter which element is absent– **Inductor**
- The potential difference across.....is proportional to the rate of change of current in it- **An inductor**
- In a pure inductive AC circuit - **Voltage leads the current by 90º**
- The pf of a practical inductor is– **Lagging**
- ..... will act as open circuit at $t = 0^+$ with zero initial conditions– **Inductor**
- For a dc voltage an inductor– **Is virtually a short circuit**
- Average power consumption of pure inductive circuit is– **Zero**
- In case of a purely inductive circuit, the current is maximum when– **Applied voltage is zero**
- ..... will be the relation between the current through a pure inductor and the voltage across the inductor– **Current will lag by 90^0**
- In a pure inductive circuit– **The current lags applied voltage by 90 degree**
- Purely inductive circuit takes power from the ac mains when– **Applied voltage decreases but current increases**
- In a pure inductive circuit if the supply frequency is reduced to $\frac{1}{2}$, the current will– **Be doubled**
- An inductor at $t = 0^+$ with zero initial conditions acts as– **Open circuit**
- In purely inductive circuit, current lags by Voltage– **90^0**
- In a series circuit, current lead voltages by 90º. The type of circuit is this - **Pure capacitor**
- The impedance of an a.c. circuit is $45\angle -30°\Omega$ - **Capacitive**
- The type of power is generated by power factor correction capacitors connected to plants- **Reactive power**
- ..... can act as an open circuit for dc and a short circuit for ac of high frequency– **A capacitor**
- Capacitive reactance is more when– **Capacitance is less and frequency of supply is less**
- In a highly capacitive circuit the– **Reactive power is more than the actual power**
- A circuit component that opposes the change in circuit voltage is– **Capacitance**
- ..... will act as short circuit at $t = 0^+$ with zero initial conditions– **Capacitor**
- An ideal voltage source will charge an ideal capacitor– **Instantaneously**
- If a unit step current is passed through a capacitor The voltage across the capacitor will be– **A ramp function**
- The average power consumed by a pure capacitor is– **0**
- The power factor of a purely capacitive circuit is– **Zero lead**

- The reactance of 1F capacitance when connected to a d.c. circuit is– **Infinite**
- The capacitive circuit are used to..... pf (Power factor)– **Increases**
- The current in capacitive circuits.....the voltage– **Leads**
- For AC, the opposition offered by capacitor is called– **Capacitive reactance**
- In pure capacitive circuit angle the voltage with respect to current it– **90^0 lagging**
- Series R-L circuit is the dual of– **Parallel RC circuit**
- Time constant of an inductive circuit– **Increases with increase of inductance and decrease of resistance**
- At ..... frequencies the parallel R-L circuit behaves as purely resistive– **Very high**
- The voltage applied across an R-L circuit is equal to ..... of V_R and V_L– **Phasor sum**
- Total instantaneous power supplied by a 3–phase ac supply to a balanced R–L load is– **Constant**
- The formula for calculating power in R–L circuit is– **VI cos ϕ**
- In an R–L series ac circuit, $X_L = R$. The phase angle is– **45^0**
- The impedance of an R-L series circuits is given by– $\sqrt{R^2 + X_L^2}$
- When an ac power is applied to a circuit having reactive load, then the voltage is– **90 degree out of phase with the current**
- The time constant value in an R–L circuit is given by– $\frac{L}{R}$
- The angular velocity of a sinusoidal voltage is– $\omega = 2\pi f$
- Inductive Impedance of a load increases with– **Increase in Frequency**
- In an R-L series circuit, the power factor is– **Lagging**
- At very high frequencies, the parallel RL circuit behave as– **A pure resistive circuit**
- What is the range of operating power factor for any given RC series circuit - **0 to 1**
- The time constant of a series R-C circuit is given by– **RC**
- At very low frequency a series R-C circuit behaves as almost purely– **Capacitive**
- A square wave is fed to an R-C circuit. Then– **Voltage across both R and C is not square**
- Total instantaneous power supplied by a 3-phase ac supply to a balanced R-C load as– **Constant**
- A Lag network for compensation normally consists of– **R and C elements**
- As frequency increases, the impedance of a RC series circuit– **Decreases**
- In a parallel R-C circuit, the current always ..... the applied voltage– **Leads**
- In a parallel RC circuit with $R>X_C$ the phase angle will be– **Greater than 45°**
- In a parallel RC circuit, the phase angle is– $\cos^{-1}\frac{Z}{R}$

- The nature of supply current in parallel RC circuit with reference to the voltage–
Leads by 90° degree
- The series and parallel resonance on L-C circuit differs in that– **Series resonance needs a low-resistance source for sharp rise in current**
- The inductive and capacitive loads–
Absorb positive and negative reactive power respectively
- In a Series L-C circuit at the resonant frequency the–
Current is maximum
- In a three-phase, balanced, delta connected system, each phase voltage contains a fundamental, a third harmonic and a fifth harmonic of RMS values : 100 V, 30 V and 20 V respectively. What is the RMS value of the line-to-line voltage– $\sqrt{100^2 + 30^2 + 20^2}$
- In electrical circuits, transient currents are associated with– **Inductors, capacitors**
- An LC circuit cannot produce oscillations, when–
Resistance is large
- The series element of a band stop filter is–
Parallel combination of L and C
- Quality factor is defined as–
$$2\pi \frac{\text{Maximum energy stored}}{\text{Total energy lost per period}}$$
- How is the transient current in a loss-less R-L-C circuit– **Sinusoidal**
- Which coil will have large resonant frequency–
A coil with large distributed capacitance
- When Q-factor of a circuit is high, then–
Impedance of the circuit is high
- A high Q-coil has– **Low losses**
- The double energy transient occur in the–
R-L-C circuit
- In a circuit containing R, L and C, power loss can take place in– **R only**
- The characteristic equation of the series RLC circuit is– $s^2 + \frac{R}{L}s + 1/LC = 0$
- In a R-L-C series circuit if voltage V across the circuit is reduced to half the current I will change to–
I/2
- The quality factor of R-L-C circuit will increase if–
Resistance decreases
- In a R-L-C circuit the impedance is given by–
$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$
- The power factor of a series R-L-C circuit at its half-power points is– **Lagging or leading**
- Transient current in an R-L-C circuit is oscillatory when– $R < 2\sqrt{\frac{L}{C}}$

- In an R–L–C circuit, the phase of the current with respect to the circuit voltage will be–
  Depends upon the value of L and C
- With the increase in frequency of a.c., the impedance of R-L-C series circuit–
  First decreases, becomes minimum and then increases
- In any AC circuit, the unit of reactive power is–
  VAR
- In series RLC circuit, the resonance generate……. Current and ……..impedance –
  Maximum, Minimum
- The principle of 'single resonating atom' may be used in the measurement of– **Frequency**
- The formula to find the power in the AC series RLC circuit is– **I^2R**
- The damping ratio of a series RLC circuit can be expressed as– **$(R/2) \times [(C/L)^{1/2}]$**
- In a loss less R-L-C circuit the transient current is–
  Sinusoidal
- In a circuit containing R, L and C power loss can take place in– **R only**
- An RLC series circuit is said to be inductive if–
  $\omega L > 1/\omega C$
- The bandwidth of an ac series circuit consisting of R, L and C is– **R/L**
- At series resonance of an A.C R-L-C circuit the impressed voltage is– **Equal to the resistive drop.**
- The exponential damping coefficient alpha is given by– **1/2 RC for a parallel RLC circuit**
- If Q of a coil is increased, its power factor will–
  Decrease
- Q factor of a coil measured by the meter is.....the actual Q of the coil–
  Some what lesser than
- The Q–factor of a coil is given by–
  Reciprocal of its power factor
- A high Q coil has a– **Low power factor**
- Selectivity's of different resonance circuits are compared in terms of their– **Band widths**
- To increase Q factor of a Coil, the wire should be–
  Thick
- Q factor of an inductive coil is given by– $\frac{2\pi fL}{R}$
- The conductance and susceptance components of admittance are- **Parallel elements**
- R-L-C Circuit having maximum Potential across the capacitor the frequency will be–
  $$f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{2L^2}}$$
- In a parallel ac circuit, if the supply frequency is more than the resonant frequency, then the circuit is–
  Capacitive

- When supply frequency is less than the resonant frequency in a parallel a.c. circuit, then circuit is– **Inductive**
- The expression for quality factor of parallel RLC circuit is– $\mathbf{R\sqrt{\frac{C}{L}}}$
- Which property is the same in series and parallel RLC resonance circuit – **Power factor is unity in both case**
- When X_L is equal to X_C then– Z=R
- At resonance, inductive reactance is equal– **Capacitive Reactance**
- Transient current in RLC circuit is oscillatory when the value of R is– **Less than** $\mathbf{2\sqrt{\frac{L}{C}}}$
- A tank circuit consists of–**A pure inductance and a pure capacitance connected in parallel**
- Which compensator will increase the bandwidth of the system– **Phase lag**
- Q-factor of a circuit is high. In such case, which magnitude is also HIGH– **Impedance**
- Resonant mode power supplies in comparison to square mode ones– **Have negligible power loss**
- Ratio of resonance frequency to band width is– **Q–factor**
- The power factor at resonance in R-L-C series circuit is- **Unity**
- For a series RLC circuit, the quality factor is defined as the ratio of– **Resonance frequency to band width**
- In series RLC circuit at resonance - **Current is maximum**
- The value of current at resonance in a series RLC circuit, is affected by the value of– **R**
- For an RLC series AC circuit, the current at series resonance is– **Maximum at unity power factor**
- In an RLC series AC circuit, if frequency is below the resonant frequency, then– $\mathbf{X_C > X_L}$
- In a series RLC High Q circuit, the current peaks at a low frequency– **Equal to the resonant frequency**
- At half power frequencies, the current in the RLC series circuit is– $\mathbf{\frac{1}{\sqrt{2}} \times}$ **current at resonance**
- What is the frequency in series Resonance condition $f_r = \mathbf{\frac{1}{2\pi\sqrt{LC}}}$
- How do the series resonant circuit behave under resonance condition- **Voltage Magnifier**
- Which is required in series RLC circuit to get Q > 1– $\mathbf{X_L > R}$
- In a Series circuit on resonance, will occur– $\mathbf{V = V_R, X_L = X_C, Z = R}$
- In a Series resonant circuit, the impedance of the circuit is– **Minimum**

- In a series resonant circuit the voltage across the circuit is the same as the voltage across– **Resistance**
- A series R-L-C circuit draws current at leading power factor at– **Less than resonant frequency**
- In a series R-L-C circuit, the voltage across inductance will be maximum– **Just after resonant frequency**
- In a series R-L-C circuit at resonance– $\omega^2 LC = 1$
- A resonance curve for a series circuit is a plot of frequency versus– **Current**
- Higher the Q of a series circuit,– **Narrower its pass band**
- A circuit with resistor, inductor, capacitor is series is resonant of 50 Hz. If all the values are now doubled, the new resonant frequency is– $\frac{f_0}{2}$
- At series resonance, the voltage across L or C is– **Much more than applied voltage**
- An RLC series circuit is resonating at 150 Hz, its impedance at 50 Hz will be– **Capacitive**
- At resonant frequency, the impedance of the series RLC circuit is– **Purely resistive**
- The lower and upper cut-off frequencies are also called as.....frequencies– **Half power**
- Q–meter is based on characteristics of– **Series resonant circuit**
- In a series R-L-C circuit, magnitude of resonance frequency can be changed by changing the value of – **L or C**
- In resonance, a parallel RLC circuit will have - **Highest Impedance**
- In a practical parallel resonant circuit,– $I_L > I_C$
- In a parallel resonant LC circuit, the line current is– **Much less than I_L or I_C**
- At parallel resonance, the circuit susceptance is– **Zero**
- At parallel resonance, the circuit admittance is equal to circuit– Conductance
- At resonant frequency, the power dissipated in a parallel resonant circuit is P. The power dissipated at half-power frequencies is– $\frac{P}{2}$
- If f_1 and f_2 are the half-power frequencies in a parallel resonant circuit, then resonant frequency is– $\sqrt{f_1 f_2}$
- At parallel resonance, the phase angle between applied voltage and line current is– Zero
- The purpose of a parallel circuit resonance is to magnify– **Current**
- The resonant frequency for a parallel circuit is given by– $\sqrt{\frac{1}{LC}}$
- The dynamic impedance of R-L and C parallel circuit at resonance is ..... ohm– **L/CR**

- A parallel circuit is said to be in resonance when the admittance is purely– **Conductive**
- In order to tune a parallel resonant circuit to a lower frequency, the capacitance must– **Be increased**
- The parallel resonant circuit is called– **Rejecter**
- In a R–L–C resonant circuit magnification is– $\frac{\omega L}{R}$
- At parallel resonance– Power factor is unity
- In a parallel a.c. circuit, power loss is due to– **Conductance only**
- The admittance of a parallel circuit is $0.12\angle -30^{o}$ S. The circuit is– **Inductive**
- The Q-factor of a parallel resonant circuit is given by– $R\sqrt{C/L}$
- What is the value of current in parallel RLC circuit under resonance condition– **Minimum**
- Power factor of a parallel RLC circuit at resonance is– **Unity**
- If a parallel resonant circuit is shunted by a resistance, then– **The circuit impedance is decreased.**
- For frequencies below the resonant frequency, a parallel LC circuit behaves as a .....load– **Inductive**
- Effective impedance in parallel resonance is given by– **L/RC**
- The safest value of current the human body can carry for more than 3 second is– **9 mA**
- The power is measured in terms of decibles in case of– **Electronic equipment**
- The frequency of domestic power supply in India is– **50 Hz**
- .....power is the vector sum of resistive and reactive power and is measured in volt amperes– **Apparent power**
- The real power taken by three-phase load is given by- $\sqrt{3}V_L I_L \cos\phi$
- The rated voltage of a 3-phase power system is given as– **R.M.S. line to line voltage**
- In a balanced star connected polyphase system the current flowing. through the neutral wires– Zero
- In a 3-ϕ circuit, true power– Cannot exceed apparent power
- In a 3-phase circuit, the load p.f. is 1. The relation between apparent power (S) and true power (P) is– **P = S**
- For most efficient use of power distribution equipment, the power factor should be– **1**
- The algebraic sum of instantaneous phase voltages in a three-phase balance circuit is equal to– **zero**
- A 3-phase load is balanced if all the three phases have the same– **Impedance and power factor**
- If one line conductor of a 3-phase line is cut, then load is supplied by ..... voltage– **Single phase**
- In a three-phase circuit, if load p.f. is decreased, the line current– **Increases**

- Total instantaneous power supplied by a 3-phase a.c. supply to a balanced R-C load is– **Constant**
- When a 3–phase system is balanced, the neutral wire carries– No current
- The power drawn by a 3-phase balance load represented– $\mathbf{P = \sqrt{3}\, V_L I_L \cos\phi}$
- The reactive power of 3- phase system be represented– $\mathbf{Q = \sqrt{3}\, V_L I_L \sin\phi}$
- The line voltage V_{RY} in a three-phase system is equal to– The phasor sum of V_{RN} and V_{NY}
- Which connection is best suited for 3-phase 4-wire service– **Δ–Y**
- In a Three phase system, the volt ampere rating is given by– $\mathbf{\sqrt{3} V_L I_L}$
- In a three-phase unbalanced load, the power factor of each phase is– Different
- Which is correct for single phase supply comparison to three phase supply. Low Reliability
- Which devices can be used to determine the sequence of each of the three phases of a three phase supply? Phase sequence indicator
- What is the principle behind the working of phase sequence indicators for 3-ϕ unbalanced 3-wire loads– **Phase voltage depends on phase sequence**
- The phase sequence is important in determining the direction of rotation of the– AC motor
- The normal phase sequence of a 3-phase AC supply is– **RYB**
- The phase sequence of a three-phase system is RYB. The other possible phase sequence can be– **RBY**
- For balanced 3-phase supply system, the phasor sum of the line currents is NOT zero if the load is– **Unbalanced star connected**
- The advantage of star-connected supply system is that– **Two voltages can be used**
- In a balance star connected system, line voltage are……. Ahead of their respective phase voltage– 30^0
- In a star connected balanced circuit the phase difference between the line voltage V_{RY} and the phase voltage V_{RN} is– $\mathbf{30^0}$
- In a star connected 3 phase system, relationship between line voltage and phase voltage is given by– $V_L = \mathbf{\sqrt{3} V_{ph}}$
- In star connection, the phase current is– Same as line current
- A balanced Y ($R_a = R_b = R_c = R_y$) leads to balanced Δ ($R_{ab} = R_{bc} = R_{ca} = R_\Delta$) when– $\mathbf{R_\Delta = 3R_Y}$
- Relationship between phase current (I_{ph}) and line current (I_L) of three phase delta connection is - $\mathbf{I_L = \sqrt{3}\, I_{ph}}$
- What is the phase relationship between line currents in a delta system– **120° between each line current**
- Which three phase system does not contain neutral.....– **Delta**

PREVIOUS YEA

1. Which relationship is true for Ohm's law?

(a) I = VR (b) V = IR
(c) R = VI (d) V = RP

UPPCL (TG-2) 08.11.2023, Shift-II
UPPCL (TG-2) 09.11.2023, Shift-II
UPPCL (TG-2) 07.11.2023, Shift-I
UPPCL (TG-2) 17.11.2023, Shift-I
UPPCL (TG-2) 03.11.2023, Shift-I
JSSC Technician-20.10.2023
KPSC Junior Instructor 19.08.2019
LMRC Maintainer Electronic Exam 2016
Electrical Instructor 13.04.2005

Ans : (b) Ohms Law statement : Ohm's law states that the voltage across a conductor is directly proportional to the current flowing through it. Provided all physical condition remain constant.

$V \propto I$

$V = IR$

Where- V= Voltage
I = Current
R= Resistance

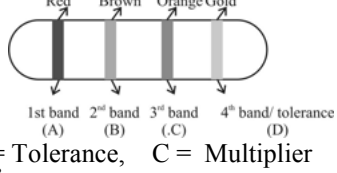
2. If the colour bands on a resistor are in the order-red, brown, orange and golden, then the value of the resistor is____.

(a) 21,000 ohms with +5% tolerance
(b) 72,000 ohms with +2% tolerance
(c) 32,000 ohms with +3% tolerance
(d) 56,000 ohms with +1% tolerance

UPPCL (TG-2) 03.11.2023, Shift-I
DSSSB Electric Driver or Electric Mistry- 11.07.2023,
ONGC Trade-20.08.2022, Shift-I

Ans. (a) : If the colour bands on a resistor are in the order-red, brown, orange and golden then the value of the resistor is 21,000 ohms with = 5% tolerance or four band resistor-

$$R = AB \times 10^{C} \pm D$$



Where, D = Tolerance, C = Multiplier

$R = 21 \times 10^{3} \pm 5\%$

Colour coding of resistance-

Colour	Value	Multiplier	Tolerance
Black	0	1	-
Brown	1	10	± 1%
Red	2	10^{2}	± 2%
Orange	3	10^{3}	± 3%
Yellow	4	10^{4}	± 4%
Green	5	10^{5}	± 0.5%
Blue	6	10^{6}	± 0.25%
Violet	7	10^{7}	± 0.10%
Grey	8	10^{8}	± 0.05%
White	9	10^{9}	-
Gold	-	10^{-1}	± 5%
Silver	-	10^{-2}	± 10%
None	-		± 20%

AR QUESTIONS

3. If you put two positive charges close together, they will____.

(a) not interact
(b) repel
(c) attract
(d) first repel then attract

CPRI Technician Grade- I, 31.07.2023

Ans. (b) : If two positive charges are put close together then they will repel because two opposite charges attract each-other and same charges repel each other.

Charge (Q) = current × time

$\boxed{Q = It}$

■ The unit of charge is Coulomb.

4. Kirchhoff's law is applicable to

(a) AC circuits only
(b) DC circuits only
(c) Passive network only
(d) Both AC and DC circuits

UPPCL (TG-2) 07.11.2023, Shift-II
KPSC Electrician– 07.05.2022

Ans. (d) : Kirchhoff's law is applicable to both AC and DC circuits.

■ Kirchhoff's current law based on conservation of charge.
■ Kirchhoff's voltage law based on conservation of energy.

5. What are the features of parallel connection?

(a) Always at a very high for distance from each other
(b) Always at a very low for distance from each other
(c) Always very close to each other
(d) Always equal distance apart from each other

UPPCL (TG-2) 03.11.2023, Shift-I
MPESB Electrician-21.12.2022, Morning

Ans. (d) : The features of parallel connections always equal distance apart from each other.

■ The total current is divided between the parallel branches.
■ The over all resistance of the circuit decreases as the number of branches increases.

6. Resistance of 50kΩ has a conductance of ?

(a) 20 S (b) 0.02 S
(c) 0.02 mS (d) 20 kS

UPPCL (TG-2) 03.11.2023, Shift-I
ISRO (SAC) Technician (B) 06.11.2016

Ans. (c) : Given,

Resistance = 50kΩ

$$R = \frac{1}{G}$$

$$G = \frac{1}{R}$$

$$G = \frac{1}{50}$$

G = 0.02miliSiens (mS)

7. The power factor of an ordinary electric bulb is

(a) Zero
(b) Unity
(c) Slightly more than unity
(d) Slightly less than unity

Chandigarh Assistant Lineman-09.04.2023

Ans. (d) : The power factor of an ordinary electric bulb is slightly less than unity.

- Power factor is the ratio of active power to the apparent power.

$$kW = kVA \cos\phi$$

$$\cos\phi = \frac{kW}{kVA}$$

- Active power also known as true power.

$$\boxed{P = VI\cos\phi}$$

Apparent power = VI

Reactive power = VI sinϕ VAR

8. Induction coil are produces :

(a) Low current at high voltage
(b) Large current at high voltage
(c) Large current at low voltage
(d) None of the above

(R.R.B. Mumbai (L.P.)-2010)

Ans : (c) Induction coil are produces large current at low voltage. Because they have the quality of coil to oppose the flow of current.

9. Power loss in an electrical circuit can take place in

(a) Inductance only
(b) Capacitance only
(c) Inductance and resistance only
(d) Resistance only

Chandigarh Assistant Lineman-09.04.2023

Ans. (d) : Power loss in an electrical circuit due to only resistance.

Power loss element → only resistance

Power loss in resistance (P) = I^2R watt

- Energy loss in resistance = I^2 Rt Joules
  = vit Joules
- Energy storing element in an electrical circuit is Inductance and capacitance
- Magnetic energy stored in inductance –

$$= \frac{1}{2} LI^2 \left[\because L = \frac{N^2}{S}\right]$$

- Electrical energy stored in capacitance –

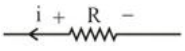
$$\frac{1}{2} cv^2 = \frac{1}{2} q.v = \frac{1}{2}\frac{q^2}{c}$$

10. To determine the polarity of the voltage drop across a resistor, it is necessary to know

(a) Value of current through resistor
(b) Direction of current through resistor
(c) Value of resistor
(d) EMF in the circuit

Chandigarh Assistant Lineman-09.04.2023

Ans. (b) : To determine the polarity of the voltage drop across a resistor, it is necessary to know direction of current through resistor.



Voltage drop = IR Volt.

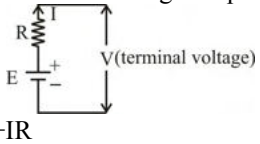
- **Thumb rule** –To determine the direction of magnetic line of force.

11. What is the formula to determine the terminal voltage of an electric circuit?

(a) Terminal voltage = EMF/Voltage drop
(b) Terminal voltage = EMF – voltage drop
(c) Terminal voltage = EMF + voltage drop
(d) Terminal voltage = EMF × voltage drop

MPESB Electrician 22.12.2022

Ans. (b) : The terminal voltage of an electric circuit is terminal voltage = EMF–Voltage drop.



$E = V + IR$

$\boxed{V = E - IR}$

$E = EMF$

$IR = \text{Voltage drop}$

12. Which among the following is the requirement of the simple electronic circuit?

(a) Voltage (b) Current
(c) Path (d) Resistance

MPESB Electrician-21.12.2022, Morning

Ans. (c) : Path is the requirement of the simple electronic circuit.

13. What will be the change in voltage when the power and resistance of a circuit increase of two times?

(a) Remains Same (b) Becomes half
(c) Becomes 4 times (d) Becomes 2 times

MPESB Electrician-21.12.2022, Morning

Ans. (d) : $P = \frac{V^2}{R}$

$V = \sqrt{PR}$

- If power and resistance of a circuit increase two times then-

$P = 2$

$R = 2$

$V' = \sqrt{2 \times 2PR}$

$V' = \sqrt{4PR} = 2\sqrt{PR}$

$\boxed{V' = 2V}$

V' = 2 time increase

14. The source impedances of ideal ac voltage source and ideal ac current source are :

(a) infinite and infinite respectively
(b) zero and zero respectively
(c) zero and infinite respectively
(d) infinite and zero respectively

TSSPDCL Junior Lineman-17.07.2022

Ans. (c) : The source impedance of ideal ac voltage source is zero and ideal ac current source is infinite respectively.

15. Name the excitation in an electric circuit

(a) EMF in volts
(b) Current in Amps
(c) Voltage Drop in Volts
(d) MMF in AT

MPESB Electrician -21.12.2022, Evening

Ans. (a) : EMF in volts the name of excitation in an electric circuit.

16. Conventional current flow in simple electrical connection is:

(a) From negative terminal to positive terminal
(b) Determined by the load
(c) Not definable
(d) From positive terminal to negative terminal

UPRVUNL (TG-II) 21.12.2022, Shift-I

Ans. (d) : Conventional current flow in simple electrical connection is from positive terminal to negative terminal.

17. In a material, application of voltage will cause a net motion of free charges from one point to another, such movement is called as :

(a) Electric power (b) Electric current
(c) Electric energy (d) Electric field

UPRVUNL (TG-II) 21.12.2022, Shift-I

Ans. (b) : In a material, application of voltage will cause a net motion of free charge from one point to another, such movement is called as electric current.

18. SI unit of electrical current is:

(a) Farad (b) Coulomb
(c) Ampere (d) Siemens

UPRVUNL TG-2 22.12.2022, Shift-II

Ans. (c) : SI unit of electrical current is Ampere.

$$i = \frac{dq}{dt}$$

Unit of electric current-Ampere, Coulomb/second.

19. When two resistors are connected in series they have

(a) Same voltage across them
(b) Same resistance value
(c) Different resistance value
(d) Same current passing through them

KPSC Electrician– 07.05.2022

Ans. (d) : When two resistors are connected in series they have same current passing through them.

The main characteristics of series circuit:-

- Same current flows through all parts of the circuit.
- Resistances are additive nature
- Voltage drop are additive nature
- Power are additive nature
- Applied voltage equals the sum of different voltage drops.
- Different resistor have their individual voltage drops.

20. 1 Coulomb charge equals to the charge on

(a) 6.24×10^{18} electrons
(b) 6.24×10^{19} electrons
(c) 6.24×10^{17} electrons
(d) 6.24×10^{12} electrons

KPSC Electrician– 07.05.2022

Ans. (a) : Solution–

Given that, charge (q) = 1 coulomb

Charge at electron ($\bar{e}$) = 1.6×10^{-19} coulomb

Number of electron (n) = ?

Formula– $q = ne$

$$n = \frac{q}{e}$$

$$n = \frac{1}{1.6 \times 10^{-19}}$$

$n = 6.24 \times 10^{18}$ electrons

21. The resistance of a conductor varies inversely as

(a) Length (b) Resistivity

(c) Diameter (d) Temperature

KPSC Electrician– 07.05.2022

Ans. (c) : The resistance of a conductor varies inversely proportional to square of diameter.

$$R = \rho \frac{l}{A}$$

$$R \propto \frac{1}{A} \qquad A = \frac{\pi}{4} d^2$$

$$\boxed{R \propto \frac{1}{d^2}}$$

22. The property of a conductor due to which it passes electric current is called

(a) Inductance (b) Capacitance

(c) Reluctance (d) Conductance

WBSETCL Technician-2023

KPSC Electrician– 07.05.2022

Ans. (d) : The property of a conductor is called conductance.

Inductance–Inductance is the property of a coil that opposes the rate of change of electric current through the coil.

Reluctance– Reluctance is a property of a magnetic material that opposes the set up of magnetic flux lines through it.

23. The resistance of a conductor doesn't depend on

(a) Load (b) Length

(c) Temperature (d) Radius

ISRO (SAC) Technician (B) 06.11.2016

Ans. (a) : The resistance of a conductor does not depend on load.

- The Resistance of a wire depends on its length, area and metal resistance.

$$R = \rho \frac{\ell}{A}$$

Where ρ = metal resistivity

A = Area

ℓ = length

- Resistance of material depends on the length (l), Areas of the wire (A) and property of the material.
- The resistance of the wire does not depend on the voltage across the wire.

24. Which of the following is not the same as watt

(a) joule/s (b) ampere/volt

(c) ampere × volt (d) $\text{ampere}^2 \times \text{ohm}$

ISRO (SAC) Technician (B) 06.11.2016

Ans. (b) : Ampere /Volt is not the same as watt.

■ Watt is the unit of power, we can represent the power is:-

$$P = \frac{V^2}{R} = \frac{Volt^2}{ohm}$$

$$P = I^2R$$

$$P = (ampere)^2 \times ohm$$

$$P = \frac{Energy}{time} = \frac{Joule}{Second}$$

25. What is Voltage drop?

(a) Maximum potential
(b) Difference in potential between two points
(c) Voltage at the end of a circuit
(d) Voltage produced by a source

ISRO (SAC) Technician (B) 06.11.2016

Ans. (b) : Voltage drop is difference in potential between two points.

■ Voltage drop is the decrease of electrical potential along the path of a current flowing in an electrical circuit.

■ Voltage drop occur due to the internal resistance of the source, passive element, across conductor are undesirable because some of the energy supplied is dissipated.

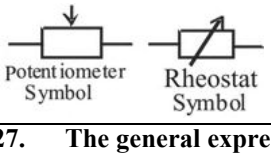
26. Variable resistors are:

(a) Wire wound resistors
(b) Thin film resistor
(c) Thick film resistors
(d) All of these

ISRO (SAC) Technician (B) 06.11.2016

Ans. (a) : Variable resistor are wire wound resistor.

■ A variable resistor is a resistor of which the electrical resistance value can be adjusted.



27. The general expression for Resistance

(a) $R = \mu \ell / A$ (b) $R = \mu A$
(c) $R = \rho A / \ell$ (d) $R = \rho \ell / A$

ISRO (SAC) Technician (B) 06.11.2016
ISRO (SAC Ahmedabad) Technician (B) 01.07.2018

Ans. (d) : Resistance is opposition to current flow in an electrical circuit.

■ Resistance is measured in ohm and it is denote by (Ω)

$$R = \frac{\rho \ell}{A}$$

■ **Factor Affecting Resistance :-** The electrical resistance of a conductor is dependent on the following factors.

■ The cross-sectional area of the conductor
■ Length of the conductor
■ The material of the conductor
■ The temperature of the conducting material.

28. What is the formula to find out the quantity of electricity 'Q'?

(a) Current/Time
(b) $(Current)^2 \times$ Resistance
(c) Current × Time
(d) (Voltage × Current)/Time

ISRO (SAC) Ahmedabad Technician (B) 18.11.2018

Ans. (c) : Formula to find out the quantity of electricity
Q = current × time

- Quantity of electricity Q is the charge in coulomb.
- Charge is a physical property of matter by the virtue of which it experiences a force of attraction or repulsion on it.

29. Resistance of a wire is r ohms. The wire is stretched to double its length and then its resistance in ohms is:

(a) r/2 (b) 4r
(c) 2r (d) r/4

ISRO (SAC Ahmedabad) Technician (B) 01.07.2018

Ans. (b) : Given that,

$R_1 = R$, $l_2 = 2l_1$

We know that

$$R = \frac{\rho \ell}{A}$$

When the wire is stretched than, then its area will be decreases automatically but volume of wire will be same-

∴ Volume of original wire = volume of new wire

$A_1 l_1 = A_2 l_2$

$A_1 l_1 = A_2 \times 2 l_1$

$$A_2 = \frac{A_1}{2}$$

Resistance of original wire.

$$R_1 = \frac{\rho \ell_1}{A_1} \quad ...(i)$$

Resistance of new wire

$$R_2 = \frac{\rho \ell_2}{A_2} = \frac{\rho \times 2\ell_1}{\frac{A_1}{2}} = \frac{4\rho \ell_1}{A_1} \quad ...(ii)$$

equation (ii) is divided by equation (i)

$$\frac{R2}{R1} = \frac{\frac{4\rho \ell_1}{A_1}}{\frac{\rho \ell_1}{A_1}} = \frac{4\rho \ell_1 \times A_1}{A_1 \times \rho \ell_1} = 4$$

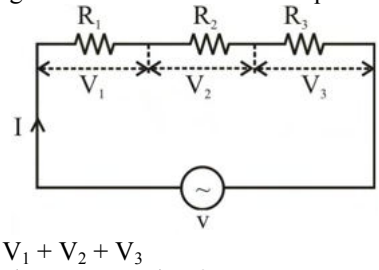
$$R_2 = 4\, R_1$$

30. All the voltage drops and the source voltage added together in a series circuit is equal to:

(a) The total of the voltage drops
(b) The source voltage
(c) Zero
(d) The total of the source voltage and the voltage drops

ISRO (SAC Ahmedabad) Technician (B) 01.07.2018

Ans. (c) : All the voltage drops and the source voltage added together in a series circuit is equal to zero.



$V = V_1 + V_2 + V_3$

$V_1 - (V_1 + V_2 + V_3) = 0$

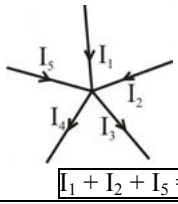
31. Which statement regarding Kirchoff's Current Law (KCL) is correct?

(a) In a closed loop or mesh, sum of voltage drop or voltage rise is zero
(b) At the node of a circuit, summation of current is zero
(c) Current flowing towards a junction is always lesser than the current leaving the junction
(d) Current flowing towards a junction is always more than the current leaving the junction

ISRO (SAC Ahmedabad) Technician (B) 01.07.2018

Ans. (b) : At the node of a circuit summation of current is zero regarding Kirchhoff's current law (KCL) is correct statement.

- In any electrical network, the algebraic sum of the current meeting at a point (or Junction) is zero.
- Kirchhoff's current law (KCL) is based on the conservations of charge.



$I_1 + I_2 + I_5 = I_3 + I_4$

32. The condition of Ohm's law is :

(a) The temperature should be remaining constant
(b) Ratio V/I should be constant
(c) Current should be proportional of voltage
(d) Temperature should vary

ISRO IPSC Tech-B 22.04.2018

Ans. (a) : The condition of ohm's law is that the temperature should be remained constant.
According to ohm's law the ratio of potential difference (V) between any two points on a conductor to the current (I) flowing between them is constant.

i.e. $\frac{V}{I} = \text{constant}$ or $\frac{V}{I} = R$

This linear relationship is only valid for metallic conductors.

33. A parallel circuit is used as divider for–

(a) Conductance (b) Voltage
(c) Power (d) Current

KPSC Electrician -30.09.2020

Ans. (d) : A parallel circuit acts as a current divider circuit because it divides the total circuit current in its all branches.

- A series circuit acts as a voltage divider circuit because it divides the total supply voltage in different voltages across various component of the circuit.

34. More the appliances connected to a parallel circuit-

(a) Less the current in the circuit
(b) More the current in the circuit
(c) Less the voltage in the circuit
(d) More the voltage in the circuit
(e) Zero the current in the circuit

JVVNL Technical Helper-02.11.2022, 12:00-14:00 PM

Ans. (b) : For more the current in the circuit more the appliances connected to a parallel circuit.

- In parallel circuit current increase.
- In series circuit voltage increase.

35. .....is an equation describing the magnetic field generated by constant electric current.

(a) Kirchhoff's Law (b) Biot - Savart's Law
(c) Ampere's Law (d) Faraday's Law
(e) Norton's Law

JVVNL Technical Helper-02.11.2022, 12:00-14:00 PM

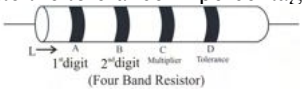
Ans. (b) : Biot-Savart's law is an equation describing the magnetic field generated by constant electric current.

36. In four band resistors, the fourth band is used to indicate-

(a) Significant digits (b) Multiplier
(c) Tolerance coefficient (d) Temperature
(e) All of the options

JVVNL Technical Helper-27.08.2022,12:00-2:00PM

Ans. (c) : In four band resistors, the fourth band is used to indicate the tolerance in percentage.



(Four Band Resistor)

There are generally four colour bands A, B, C and D in which first three colour band (A, B, And C) give value of the resistance while the fourth band tells about tolerance in percentage.

Colour	Tolerance
Gold	±5%
Silver	±10%
None	±20%

37. An inductor oppose changes in-

(a) Voltage (b) Current
(c) Resistance (d) Capacitance
(e) Energy

JVVNL Technical Helper-27.08.2022,12:00-2:00PM

Ans. (b) : An Inductor oppose changes in current.

- An inductor opposes the rate of change of current flowing through it.

When current through a coil changes an e.m.f is induced in it.

$$e = \frac{Ldi}{dt}$$

- An inductor stores the energy in the form of magnetic field.

38. The letter code for resistor tolerance value of ± 1% is-

(a) F (b) J
(c) G (d) M
(e) K

JVVNL Technical Helper-27.08.2022,12:00-2:00PM

Ans. (a) : The letter code for resistor tolerance valve of ± 1% is F.

39. The ..... is not considered to fix the potential-raise or potential-drop across a source of emf.

(a) Voltage positive direction
(b) Current direction
(c) Power produce direction
(d) Voltage negative direction

NFL Electrician-18.12.2021, 4:00-6:00 PM

Ans. (b) : The current direction is not considered to fix the potential - raise or potential-drop across a source of emf.

Unit of EMF = Volt
Power = Watt
Current = Ampere.

40. .....of the source will be available at open circuit terminals

(a) Full voltage (b) Full current
(c) Zero voltage (d) Half current

NFL Electrician-18.12.2021, 4:00-6:00 PM

Ans. (a) : Full voltage of the source will be available at open circuit terminals.

- At open circuit terminal, the resistance is infinite.
- At the short circuit, current is maximum in the circuit.
- At short circuit condition, resistance becomes zero.

41. The voltage difference across two points in a circuit is called-

(a) Potential difference (b) Electrical power
(c) Current in the path (d) Electrical Energy

UPPCL TG-2, 27.03.2021 Shift I

Ans (a) : The difference of voltage between two points in a circuit is called potential difference.

- Numerically, equal to the work done in bringing a positive charge of one coulomb from infinity to that point against the electric field. Unit of potential volt or joule per coulomb.

Electric Field Intensity - It is given by the force experienced by a unit positive charge placed at that point. Its direction is the direction along which the force acts.

Force (F) = Coulomb (q) × Electric Field Intensity (E)

- Unit of E is Newton/ coulomb or (N/C)

42. Which type of combination is given the inverse equivalent resistance by the algebraic sum of the inverses of the individual resistances?

(a) Star series combination
(b) Parallel connected combination
(c) Parallel and series both combination
(d) Series connected combination

UPPCL TG-2, 28.03.2021 Shift I

Ans : (b) Parallel connected combination is given the inverse equivalent resistance by the algebraic sum of the inverses of the individual resistances.

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots\cdots\cdots + \frac{1}{R_n}$$

43. Conductivity is the inverse of .....

(a) Electric field
(b) Specific Resistance
(c) Electric flux density
(d) Resistance

UPRVUNL TG-2, 14.07.2021 Shift II

Ans. (b) : Conductivity is the inverse of specific resistance.

$$\text{Conductivity } (\sigma) = \frac{1}{\text{Specific Resistance } (\rho)}$$

$$\boxed{\sigma = \frac{1}{\rho} \text{mho/m}}$$

44. Electric resistance .....flow of current.

(a) Attraction (b) Conductance
(c) Opposition (d) A Path

UPRVUNL TG-2, 14.07.2021 Shift II

Ans. (c) : Electric resistance opposition of flow of current.

$$R = \frac{V}{I}\Omega$$

45. Resistivity: Conductivity:: Ohm- meter:?

(a) mho-meter (b) Siemens/meter
(c) Ohm/meter (d) Unitless

UPRVUNL TG-2, 14.07.2021 Shift II

Ans. (b) : Unit of conductivity is Siemens/meter conductivity is reciprocal of resistivity.

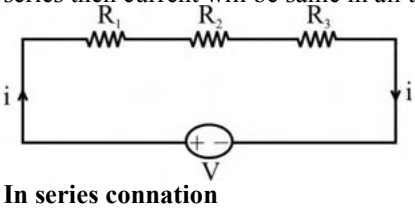
- Unit of resistivity is ohm-meter.
- Unit of resistance is ohm.
- Unit of conductance is Siemens.

46. If three resistor R_1, R_2 and R_3 are connected in series then current will be.....?

(a) Same in all three resistance
(b) Equal to the voltage applied to all the three conductors.
(c) Will be different because of their different resistance
(d) Zero

UPRVUNL TG-2, 15.07.2021 Shift I

Ans (a) : If three resistor R_1, R_2 and R_3 are connected in series then current will be same in all three resistance.



In series connation

- Same current flows through all parts of the circuit.
- Different resistors have their individual voltage drops
- Resistance are additive.
- Power are additive.

47. According to ohm's law, when..... is kept constant, then the current is directly proportional to the potential difference across the conductor.

(a) Temperature (b) Resistance
(c) Power (d) Time

UPRVUNL TG-2, 15.07.2021 Shift I

Ans (a) : According to ohm's law, when temperature is kept constant, then the current is directly proportional to potential difference across the conductor.

$$I \propto V$$

$$\frac{V}{I} = R \text{ (Constant)}$$

Where, V = Voltage
I = Current

- Unit of this constant (R) is ohm.

48. The flow of current in any wire is the result of the:

(a) motion of neutrons
(b) no effect of motion of charges
(c) motion of positive charge

(d) motion of negative charge

UPRVUNL TG-2, 14.07.2021 Shift I

Ans (d) : Flow of current in a wire is the result of movement of negative charge.

- Charge on the electron is $[-1.6\times10^{-19}]$ coulombs.
- The flow of one coulombs charge should required to 6.25×10^{18} electron.

49. Which of the following is NOT a type of resistor?

(a) Carbon composition type
(b) Wood type
(c) wire wound type
(d) metal film type

UPRVUNL TG-2, 14.07.2021 Shift I

Ans (b) : Wood type is not a type of resistor.
The resistor can be divided as follows-
1. Carbon Composition type
2. Wire wound type
3. Metal film type
4. Ceramic metal type

50. The superposition principle is valid for:

(a) non-linear circuit, dependent sources
(b) non-linear circuit, independent sources
(c) linear circuit
(d) linear circuit, dependent sources

UPRVUNL TG-2, 14.07.2021 Shift I

Ans (c) : This theorem is applicable only for linear network, where current is linearly related to voltage as part ohm's law.

Super position Theorem:- In a network of linear resistance containing more than one source, the current which flows at any point is the sum of the currents which would flow at that point if each generator where considered separately and all the other source replaced for the time being by resistance equal to their internal resistance.

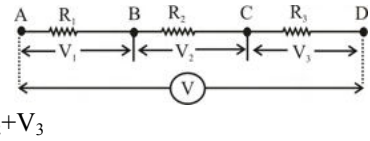
- Superposition theorem is used to linear and bilateral network.
- Power cannot calculate by this theorem.

51. In which circuit, the current is same at any point of circuit?

(a) Short circuit (b) Loose circuit
(c) Parallel circuit (d) Series circuit

UPPCL TG-2, 27.03.2021 Shift I

Ans (d) : The current is same at any point of circuit in series circuit.



$V= V_1+V_2+V_3$

$V= IR_1 + IR_2+ IR_3$

- Same current flows through all parts of the circuit
- Different resistors have their individual voltage drops.
- Voltage drop are additive in nature.
- Applied voltage equals to the sum of different voltage drops
- Resistance are additive
  $R_{eq} = R_1+ R_2+R_3 +.....R_n$
- Power are additive.

52. The factor considered for designing of an electrical wire are.

(a) Current
(b) Monthly electricity bill
(c) P.T. ratio
(d) Energy meter reading

UPRVUNL TG-2, 15.07.2021 Shift II

Ans (a) : Current is the main factor consider for designing of an electrical wire.

Area of Conductor & Current Rating

■ Design of insulation is depend upon voltage.

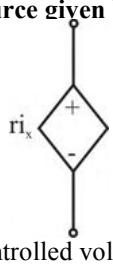
53. In case of short circuit, voltage and current is to be respectively?

(a) Zero, abnormally high
(b) Abnormally high, zero
(c) Abnormally high, abnormally high
(d) Zero, Zero

UPRVUNL TG-2, 15.07.2021 Shift II

Ans (a) : In short circuit case, voltage is to be zero and current abnormally high.

54. Identify the source given below.

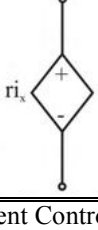


(a) Current controlled voltage source
(b) Voltage controlled current source
(c) Current controlled current source
(d) Voltage source

UPPCL TG-2, 19.03.2021 Shift I

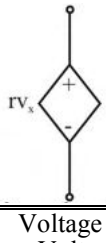
Ans : (a) Identify the source given below Current controlled voltage source.

(I)



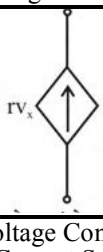
Current Controlled Voltage Source

(II)



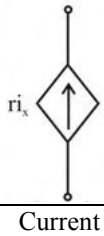
Voltage Controlled Voltage Source

(III)



Voltage Controlled Current Source

(IV)



Current Controlled Current Source

55. Which one of the following is an aluminium electrolytic capacitor?

(a) Film capacitor
(b) AC type capacitor
(c) Tantalum capacitor
(d) DC type capacitor

UPPCL TG-2, 19.03.2021 Shift I

Ans (d): Electrolytic capacitor is basically a DC capacitor, it has positive and negative terminals generally an electrolytic capacitor is made to provide a high value of capacitance.

56. Which of the following gives the appropriate relation for current density for a conductor?

(a) Cross-section of area + electric current

(b) $\frac{\text{Electric Currenct}}{\text{Cross-section area}}$

(c) Cross-section of area × Electric current

(d) $\frac{\text{Cross-Section Area}}{\text{electric current}}$

UPPCL TG-2, 19.03.2021 Shift I

Ans (b): The electric current flowing through a unit area in the direction perpendicular to a surface inside the conducting medium is called current density.

- It is a vector quantity.
- The current density is denoted by 'J'.

If a current 'I' flows through a conductor and its cross - sectional area is 'A' then the current density

$$\boxed{J = \frac{I}{A}} \left(\frac{\text{Electric current}}{\text{Cross - sectional of area}}\right)$$

It's SI unit is ampere/m^2

57. The resistivity of a conductor depends on its:

(a) Length

(b) Cross-sectional area

(c) Material

(d) Volume

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (c) : The resistivity of a conductor depends on its material. It is denoted by ρ. Its unit is ohm- meter.

$$\boxed{\rho = \frac{Ra}{l}}$$

58. Which law represents the relation between voltage, current, and resistance in a circuit ?

(a) Kirchhoff's law (b) Ohm's law

(c) Lenz's law (d) Ampere's law

UPPCL TG-2, 27.03.2021 Shift II

Ans (b) : **Ohm's law-**

The law representing the relation between voltage, current and resistance is called according to ohm's law-

$$V \propto I$$

$$\boxed{\frac{V}{I} = R}$$ (Where, R is a constant resistance)

Where, V = Voltage

I = Current

R = Resistance

- Ohm's law is not applicable to unilateral networks.
- Ohm's law is also not applicable to non - linear element but only applicable linear element.

59. "The net emf around a closed - circuit loop is equal to the sum of the potential drops around the loop" - this statement is related to which of them?

(a) Kirchhoff's law of current

(b) Kirchhoff's law of voltage

(c) Kirchhoff's faraday's law

(d) Lange's law

UPPCL TG-2, 27.03.2021 Shift II

Ans (b) : **Kirchhoff's voltage law (KVL)-**
"The net emf around a closed - circuit loop is equal to the sum of the potential drops around the loop"

$$\sum IR + \sum e.m.f = 0$$

■ KVL is based on the conservation of energy.

Kirchhoff's current law (KCL)-
It states that the algebraic sum of currents, entering a node or closed boundary is zero.

$$\sum_{n=1}^{N} i_n = 0$$

■ KCL is based on the conservation of charge.

60. Ohm's law applies to which of the following?
(a) Only for DC circuit
(b) Only for AC circuit
(c) Both for AC and DC circuit
(d) Non-linear circuit

DMRC Maintainer 20.02.2020 (9.00-10.30)
MP Line Attendant 14.08.2018

Ans. (c) Ohm's law applies for both AC and DC circuit.
Ohm's law:- Ohm's law states that the voltage across a conductor is directly proportional to the current flowing through it, provided all physical conditions and temperature remain constant.

$$V \propto I$$

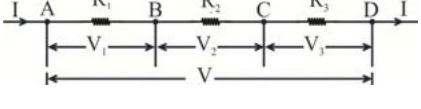
$$\boxed{\frac{V}{I} = \text{contant}}$$

$$\frac{V}{I} = R$$

61. If the resistance are connected is series, which of the following will be true?
(a) The value of temperature coefficient will be same.
(b) The value of each resistance will be the same.
(c) The value of current flowing through each resistance will be the same.
(d) The voltage value between each resistance terminals will be the same.

DMRC Maintainer 18.02.2020 (9.00-10.30)

Ans (c) : If the resistors are connected in series, then the value of current flowing in each circuit will be same. But due to different resistance the voltage drop will be different. The sum of the voltage across different resistances is equal to the applied voltage.



$V = V_1 + V_2 + V_3$
$IR = IR_1 + IR_2 + IR_3$

$$\boxed{R = R_1 + R_2 + R_3}$$

62. $R = \rho \frac{\ell}{A}$, In this equation ρ represents:
(a) Conductivity (b) Mobility
(c) Resistivity (d) Velocity

RSMSSB Instructor (Electrician) 24.03.2019

Ans. (c) : In the above equation stand for specific resistance or resistivity.

$$R = \rho \frac{l}{A}$$

- Resistivity of any material depends on the nature of the material.
- The unit of resistivity is Ohm-meter.

63. The resistance of a uniform metallic conductor is directly proportional to its-

(a) Mass (b) Length
(c) Width (d) Height

RSMSSB Instructor (Electrician) 24.03.2019

Ans. (b) : The resistance of a uniform metallic conductor is directly proportional to length.

$$R = \rho \frac{l}{A}$$

$$R \propto l$$

$$R \propto \frac{1}{A}$$

- It is clear from the above relation that the resistance of a metallic conductor is directly proportional to the length and inversely proportional to the area.

64. Two ampere hour (Ah) is equal to how many coulombs?

(a) 2 C (b) 8400 C
(c) 7200 C (d) 2400 C

RRB JE- 01.09.2019

Ans. (c) : q = it = Ampere × Second · Coulomb
= 1 × 60 × 60 = 3600 Coulomb

∵ 1 Ah = 3600 coulombs

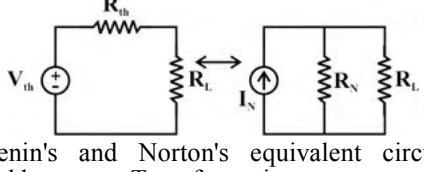
∴ 2 Ah = 3600 × 2
= 7200 coulombs

65. Which of the following theorem is dual of Thevenin's theorem?

(a) Norton's theorem
(b) Reciprocity theorem
(c) Millman's theorem
(d) Superposition theorem

DFCCIL Executive Electrical-20.12.2023, 4:30-6:30 PM

Ans. (a) : Norton's theorem is also known as the dual of Thevenin's theorem because in Norton's theorem we find short circuit current which is the dual of open circuit voltage-what we find in Thevenin's theorem.



- Thevenin's and Norton's equivalent circuits are related by source Transformations as:

$$I_N \quad \frac{V_{th}}{R_{th}}$$

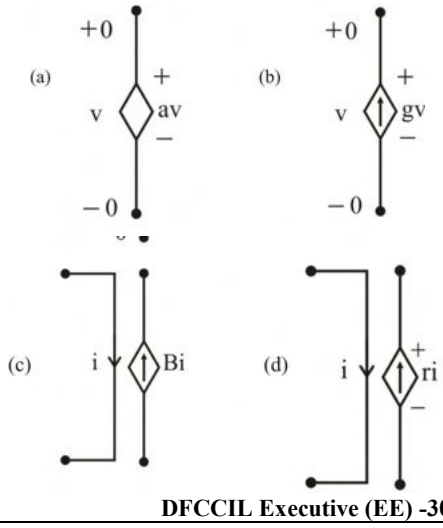
66. The resistances in the higher range an mostly made of :

(a) Carbon (b) Aluminium
(c) Silicon (d) Germanium

RRB Bhopal SSE-09.09.2012
RRB Kolkata Technical-III, 20.08.2006

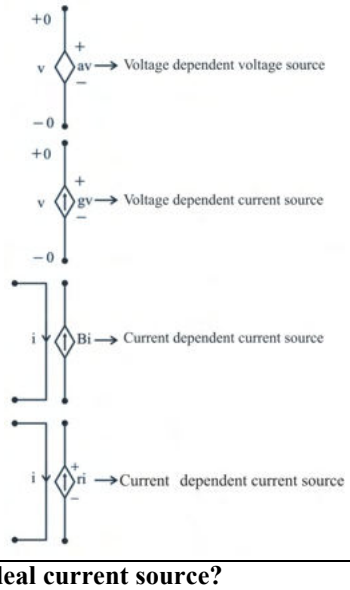
Ans : (a) The resistance is the higher range an mostly made of carbon. Resistance is the property of an electric circuit that transform electrical energy into heat energy in opposing electric current, resistance depend on the material of the conductor.

67. Which of the following figures is correct in representing the voltage-dependent current source?



DFCCIL Executive (EE) -30.09.2021

Ans. (b) :



68. An ideal current source?

(a) Infinite source resistance
(b) Zero source resistance
(c) Large value of source resistance
(d) Finite value of source resistance

RRB JE (Shift-III) 28.08.2015
RRB JE (Shift-I) 29.08.2015

Ans. (a) : An ideal current source has infinite internal resistance so that changes in load resistance will not change the current supplied.
There is a duality between the concepts of an ideal voltage source and an ideal current source. The ideal voltage source has constant voltage and zero source resistance and ideal current source has constant current and zero source conductance.

69. One ampere means the flow of

(a) One coulomb per minute
(b) One electron per second
(c) One coulomb per second
(d) One coulomb per hour

DMRC (Regular)-2020

Ans. (c) : One ampere means the flow of one coulomb per second

Current $I = \frac{q}{t}$

Where, q = Charge in Coulomb

t = Time in second

70. The flow of electrons in a circuit takes place?

(a) Magnetic charge (b) E.M.F.

(c) Electric current (d) Electric charge

RRB Guwahati Electronic- 2014, SAIL 29.3.2014

Ans : (c) The flow of electrons in a circuit takes place electric current.

Flow of electrons in circuit called electric current. The direction of current is assumed to be opposite to the flow of electrons.

71. Which of the following circuit configurations has the same amount of voltage drop across each of its components?

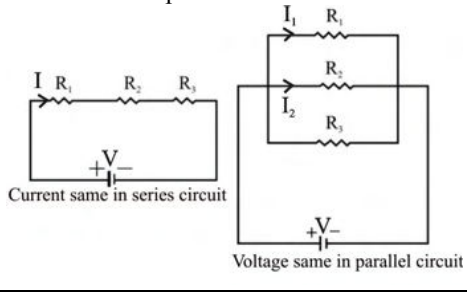
(a) parallel (b) series-parallel

(c) series (d) combination

RRB SSE (shift-III), 02.09.2015

Ans : (a) Parallel circuit configurations has the same amount of voltage drop across each of its components.

Series circuit configuration has the same amount of current across its components.



72. If a resistor suddenly decreases in value (resistance decreases), what will happen to the current through the resistor?

(a) increases

(b) remains unchanged

(c) decreases

(d) fluctuates

RRB SSE (shift-III), 02.09.2015

Ans : (a) According to Ohms law –

$$I = \frac{V}{R} \quad \Rightarrow \quad \uparrow I \propto \frac{1}{R \downarrow}$$

If, value of resistance will decrease then value of current will increase.

73. Mesh analysis is based on–

(a) Kirchhoff's Voltage law

(b) Kirchhoff's Current law

(c) Law of Conservation of Momentum

(d) Law of Conservation of Energy

RRB JE (Shift-I), 29.08.2015, SAIL 29.3.2014

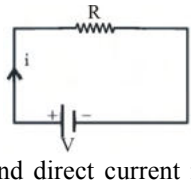
Ans : (a) Mesh analysis is based on Kirchhoff's voltage law. Kirchhoff's voltage law states that the sum of the voltage differences around any closed loop in a circuit must be zero.

74. Ratio of voltage and direct current in a closed electric circuit-

(a) Constant (b) Variable
(c) Increases (d) Decreases

RRB Chandigarh Electronic–2014

Ans : (a)



Ratio of voltage and direct current in a closed electric circuit is constant -

So, $\frac{V}{I} =$ Constant

75. What is the unit of measure for electrical pressure or electromotive force?

(a) amperes (b) ohms
(c) volts (d) Watts

RRB SSE (shift-III), 02.09.2015

Ans : (c) The unit of measure for electrical pressure or electromotive force is volts.

Current	-	Amperes
Resistance	-	Ohm
Power	-	Watt

76. A network that does not have either voltage or current sources is called :

(a) Active network
(b) Passive network
(c) Resistive network
(d) Dummy network

RRB SSE (Shift-III), 01.09.2015
RRB Mumbai 2015

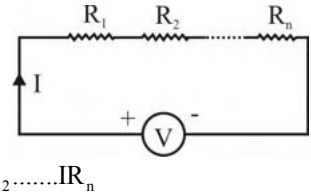
Ans : (b) The network having neither current source nor voltage source is called passive network.
Ex. - Resistor, Capacitor, Inductor etc.
No energy source is connected in this network.

77. The algebraic sign of an IR drop primarily dependent upon the …….

(a) Amount of current flowing through it
(b) Value of R
(c) Direction of current flow
(d) Battery connection

RRB Allahabad Electronic (Paper-I) – 2014

Ans : (c) The algebraic sign of an IR drop primarily dependent upon the Direction of current flow.



$V = IR_1 + IR_2 .....IR_n$

78. Kirchhoff's Current Law is applicable only to:

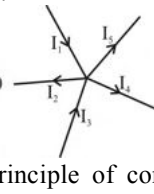
(a) Closed loops in a network
(b) Electronic circuits
(c) Junctions in a network
(d) Electrical Circuits

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM
RRB Bilaspur SSE Yellow Paper-11.12.2014

Ans. (c) : Kirchhoff's Current Law (KCL) - The algebraic sum of the currents flowing through a junction is zero. The Kirchhoff's current law is also known as the Kirchhoff's junction rule.

$I_1 + I_3 - I_2 - I_4 - I_5 = 0$

$\Sigma I = 0$



- KCL is based on the principle of conservation of electric charge.

79. The specific resistance of a conductor depends on the

(a) Length of the conductor
(b) Area of the cross-section of the conductor
(c) Resistance of conductor
(d) Nature of the material of the conductor

DMRC (Regular)-2020

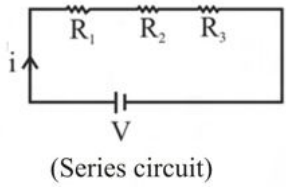
Ans. (d) : Specific resistance - The factor that shows the quality of resistance of any material is known as specific resistance. Its unit is Ω-m.
It depends on the nature of material and it also changes with change in temperature.

80. If all the elements in a circuit are carrying the equal amount of current then the elements are said to be in _____ connection.

(a) Parallel (b) Series
(c) Undefined path (d) Closed

DFCCIL S&T 17.04.2016, Shift-II

Ans. (b) : If equal current flows in all the elements of any circuit then all elements are supposed to be connected in series.



(Series circuit)

81. The nodal method of circuit analysis is based on

(a) KVL and Ohm's law
(b) KCL and Ohm's law
(c) KCL and KVL
(d) KCL, KVL and Ohm's law

RRB JE (Shift-2), 29.8.2015

Ans. (b) : The nodal method of circuit analysis is based on KCL and ohm's law. The mesh method is based on KVL and ohm's law.

82. The circuit whose properties are the same in either directions is known as

(a) Unilateral circuit (b) Bilateral circuit
(c) Reversible circuit (d) Irreversible circuit

LMRC SC/TO Shift-2 J.E. 2016

Ans : (b) The circuit whose properties are the same in either directions is known as bilateral circuit.

83. A network is said to be linear if and only if-

(a) Principle of additivity applies
(b) Principle of homogeneity applies
(c) Both Principle of additivity and Principle of homogeneity

(d) Response is proportional to the excitation function

RRB JE 31.08.2019

Ans. (c) : A network is said to be linear only if it obeys both the additivity and homogeneity principles. A linear element is one whose parameters do not change with voltage or current.
(i) Homogeneity
(ii) Additivity
Ex. - Resistor, Inductor, Capacitor.

84. The Kirchhoff's laws fail in which of the following circuits?
(a) Linear circuits
(b) Distributed parameter circuits
(c) Lumped parameter circuits
(d) Non linear circuits

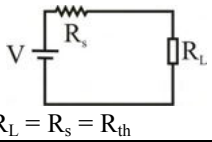
RRB JE-31.08.2019

Ans. (b) : The Kirchhoff's laws fail in distributed parameter circuits.
Kirchhoff laws -
First law - The algebraic sum of currents at any node is equal to zero in any electrical circuit.
Second law - The algebraic sum of product of voltage in any closed circuit is zero.

85. "Maximum power output is obtained from a network when the load resistance is equal to the output resistance of the network as seen from the terminals of the load". The above statement is associated with:
(a) Millmans theorem
(b) Thevenin's theorem
(c) Superposition theorem
(d) Maximum power transfer theorem

LMRC JE Electronics 2016

Ans : (d) "Maximum power output is obtained from a network when the load resistance is equal to the output resistance of the network as seen from the terminals of the load". The above statement is associated with maximum power transfer theorem.
i.e.



$R_L = R_s = R_{th}$

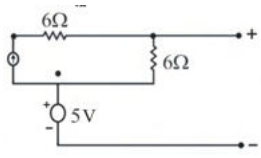
86. Which of the following is considered to be the dual of Norton's theorem?
(a) Millman's theorem
(b) Thevenin's theorem
(c) Superposition theorem
(d) Maximum power transfer theorem

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (b) : Dual of Norton's theorem is Thevenin's theorem.

Element	**Dual**
Voltage	Current
Norton's theorem	Thevenin's theorem
Resistance	Conductance
Impedance	Admittance
Reactance	Susceptance
KCL	KVL
Loop	Node pair

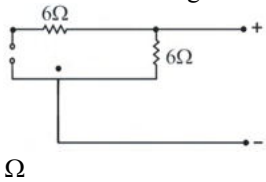
87. For the circuit shown, Thevenin's resistance R_{th} is:



(a) 6Ω (b) 2.4Ω
(c) 4Ω (d) 10Ω

DMRC Electronics 11.04.2018, 4:30 to 6.45 PM

Ans. (a) : According to Thevenin – On opening the current source and short circuiting the voltage source .



$R_{th} = 6\ \Omega$

88. The total number of links needed in a fully connected network containing 20 nodes is.

(a) 220 (b) 190
(c) 200 (d) 180

DMRC 23.02.2020, Shift-I

Ans. (b) : Given that,

$N = 20$

$$\text{Number of links} = \frac{n(n-1)}{2}$$

$$= \frac{20(20-1)}{2}$$

$$= 190$$

89. The dual of a link is

(a) Twig (b) Node
(c) Loop (d) Tree branch

LMRC SC/TO Shift-2 J.E. 2016

Ans : (d) The dual of a link is twig -

$$L = \frac{N(N-1)}{2}$$

• Table of dual element-

Element	**Dual Element**
Mesh	Node
Link	Twig
Star Network	Delta Network
Resistance	Conductance
Inductance	Capacitance
Voltage source	Current source
π network	T network

90. The number of links required in a Mesh topology to connect N number of nodes is_____.

(a) $\frac{N(N+1)}{2}$ (b) $\frac{N(N-1)}{2}$
(c) 2N (d) N

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (b) : The number of links required in a mesh topology to connect N number of nodes is

$$L = \frac{N(N-1)}{2}$$

Mesh Topology - In a mesh topology, every devices has a dedicated point to point link to every other device.

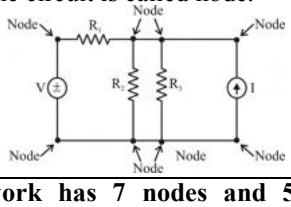
A fully connected mesh network therefore has N(N–1)/2 physical channels to link n device.

91. The point of intersection of two or more branches in any network is known as:

(a) Branch (b) Node
(c) Twig (d) Path

DFCCIL EE 17.04.2016, Shift-II

Ans. (b) : The point of intersection of two or more branches in any network is known as node.
Node - The point through which a circuit element is connected to the circuit is called node.



92. A network has 7 nodes and 5 independent loops. What is the total number of branches in this network?

(a) 12 (b) 11
(c) 13 (d) 10

RRB JE 31.08.2019

Ans. (b) : Given that,

Node, n = 7
Loop, $l = 5$
branch, b = ?
$l = b - n + 1$
$b = l + n - 1$
$b = 5 + 7 - 1$
$\boxed{b = 11}$

93. Which of the following has the highest resistivity -

(a) Mica (b) Paraffin
(c) Air (d) Mineral oil

RRB JE Bhopal Paper-I (Shift-II), 28.08.2015

Ans : (c) Air has the highest resistivity. Its resistivity is approximate $2\times10^{16}\Omega$-m .

94. What is the term used to describe the ability of a device to store energy in the form of an electrical charge?

(a) inductance (b) conductance
(c) reactance (d) capacitance

(RRB SSE (shift-III), 02.09.2015)

Ans : (d) Capacitor – Electrical component that consist of two conductors separated by an insulator or dielectric material is known as capacitors. Capacitor stores energy in the form of an electrical charge.

$$E = \frac{1}{2}CV^2$$

A capacitor is used for power factor improvement.

95. A capacitor is basically constructed of–

(a) Conductor and Semiconductor
(b) Conductor and Dielectric
(c) Two conductors separated by a dielectric
(d) Two dielectric separated by a conductor

RRB JE (Shift-III), 16.09.2015

Ans : (c) A capacitor consist of two conductor separated by an insulator or dielectric material.

$$C = \frac{\varepsilon_0\varepsilon_r A}{d} F$$

96. Electric charge in the capacitor-

(a) Stored in metal plates
(b) Stored in dielectric
(c) Both (a) and (b)
(d) Neither on the above

RRB Chandigarh Electronics– 2014

Ans : (b) The electric charge in the capacitor is stored in dielectric because when a dielectric material is placed between two plates. The charge gets store in dielectric material.

97. The reactance of capacitors increases as :

(a) applied voltage increases
(b) AC frequency increases
(c) applied voltage decreases
(d) AC frequency decreases

RRB SSE (Shift-II), 03.09.2015), SAIL 29.3.2014
RRB Bhubaneswar 19.08.2001

Ans (d) : The reactance of capacitors increases as AC frequency decreases.

$$X_C = \frac{1}{\omega C}$$

$$\omega C = 2\pi fC$$

$$\text{Capacitive reactance } (X_C) = \frac{1}{2\pi fC}$$

$$\uparrow X_C \propto \frac{1}{f\downarrow}$$

98. The power factor of an AC circuit is defined as the ratio of:

(a) W/VA (b) A/VW
(c) VA/W (d) V/WA

DFCCIL Executive (EE) -30.09.2021
RRB Bhubaneswar JE-II, 29.11.2008

Ans. (a) : Power factor of single-phase ac circuit -

$$\cos\phi = \frac{P}{VI} = \frac{\text{Power}}{\text{Voltage} \times \text{Current}}$$

So, power factor $\boxed{\cos\phi = \frac{W}{VA}}$

99. Which of the following identifies inductance?

(a) Ohm's law (b) Coulomb's law
(c) Faraday's law (d) Newton's law

DFCCIL Executive Electrical 20.12.2023, 4:30-6:30 PM

Ans. (c) : Faraday's law indentifies inductance. Inductance is the property of device that tells how effectively it induces an emf in another device or on it self. Induction is the process in which an emf is induced by changing magnetic flux.

$$\boxed{EMF(V) = -L\frac{dI}{dt}}$$

100. The SI unit of circuit element inductance is:

(a) Ohm (b) Henry
(c) Faraday (d) Volt

DFCCIL Executive (EE) -30.09.2021

Ans. (b) :

Element		SI Unit
Resistance	→	Ohm
Inductance	→	Henry
Capacitance	→	Farad
Potential	→	Volt

101. To optimise the economic limit, power factor is improved by installing _____.

(a) transformers (b) kVA rating devices
(c) static capacitors (d) energy meters

UPMRC (SCTO) 14.04.2021

Ans. (c) : To optimise the economic limit, power factor is improved by installing static capacitor.

Advantage :

- They have no rotating parts
- They have low loss.
- They require low maintenance.
- They can work ordinary atmospheric condition.

102. Which of the following are NOT passive elements?

(a) Inductors (b) Transistors
(c) Resistors (d) Capacitors

DFCCIL Executive (EE) -30.09.2021

Ans. (b) : Passive elements - Electrical components which do not generate power but dissipates it, are called passive elements.

Ex. - Resistor, Capacitor, Inductor etc.

Active elements - Electrical components which are capable of generating electrical energy called active elements.

Ex. - Voltage source, Current source, Generator, Transistor etc.

103. Time constant of a series R-L circuit is-

(a) LR sec. (b) $\frac{L}{R}$ sec.
(c) L^2R sec. (d) LR^2 sec.

RRB Allahabad Electronic (Paper-II) – 2014

Ans : (b) R →Resistance
L → Inductance

For series R-L circuit –

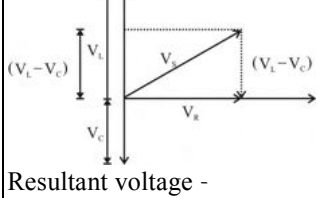
Time constant (τ) = $\frac{L}{R}$ second

104. Voltage Triangle for a series RLC circuit is given as:

(a) $V_S^2 = V_R^2 + (V_L - V_C)^{1/2}$
(b) $V_S = V_R^2 + (V_L - V_C)^2$
(c) $V_S^2 = V_R^2 + (V_L - V_C)^2$
(d) $V_S = V_R^2 + (V_L - V_C)$

DFCCIL Executive (EE) -30.09.2021

Ans. (c) : Voltage Triangle for a series RLC circuit is -



Resultant voltage -

$$V_s^2 = V_R^2 + (V_L - V_C)^2$$

Where, V_R = Voltage across resistor
V_L = Voltage across inductor
V_C = Voltage across capacitor

105. The impedance of an electric circuit may be defined as:

(a) a phenomenon in which applied voltage and resulting current are in-phase

(b) the frequency at which resonance occurs
(c) the opposition of circuit to flow of alternating current
(d) a phenomenon in which applied voltage and resulting current are not in-phase

DFCCIL Executive (EE) -30.09.2021

Ans. (c) : Impedance :- The complex quantity of the resistance is defined as the impedance of a circuit. It is the same as that of resistance.
It is an electrical parameter that is used as the measurement of opposition to the alternating electric current.

106. The phasor values of voltage and current are:
$V = 100\angle 30^\circ$; $I = 10\angle -45^\circ$
What is the phase difference between them?
(a) 45º (b) 15º
(c) 75º (d) 30º

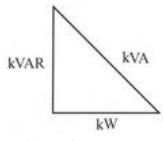
UPMRC (SCTO) 14.04.2021

Ans. (c) : Given that -
V = $100\angle 30^\circ$
I = $10\angle -45^\circ$
Phase difference = 30 – (–45)
= 75º

107. What is the correct formula to convert apparent power in kilovolt-amps (kVA) to real power in watts(W), assuming power factor is pf.
(a) W= 1000 ×kVA×pf
(b) W = kVA×pf
(c) W = (kVA×pf)/1000
(d) W = (1000×kVA)pf

JMRC JE-05.02.2021

Ans. (c) :



kW = kVA × Cos ϕ

$$W = \frac{kVA \times pf}{1000}$$

108. According to star connected system, the line voltage in a 3-phase circuit is
(a) 1.732 times the phase voltage
(b) 1.414 times the phase voltage
(c) 2.05 times the phase voltage
(d) Equal to the phase voltage

LMRC SC/TO Shift-2 J.E. 2016

Ans : (a) In a star-connected three-phase system,
$V_L = \sqrt{3}V_{ph} = 1.732\ V_{ph}$
$I_L = I_{ph}$
Total power $P = \sqrt{3}V_L I_L \cos\phi = 3V_{ph}.I_{ph}\cos\phi$
In delta connected three-phase system.
$V_L = V_{ph}$
$I_L = \sqrt{3}\,I_{ph} = 1.732\ I_{ph}$
The power $P = \sqrt{3}\ V_L I_L \cos\phi = 3V_{ph}.I_{ph}\cos\phi$

109. In a 240V power supply, 240V signifies
(a) V_{rms} (b) V_{avg}
(c) V_{max} (d) None of the above

RRB Jharkhand Electronic – 2014

Ans. (a) : In a 240V power supply, 240V signifies V_{rms} value.

- Residential 240V outlets usually have three or four connectors.

110. In an AC circuits kW/kVA ratio represents-

(a) Power factor (b) Form factor
(c) Load factor (d) Diversity factor

RRB JE Secunderabad (Shift-I), 18.08.2015
(RRB SSE (Shift-II), 01.09.2015)

Ans : (a)

$P = VI\cos\phi$

$$\cos\phi = \frac{P}{VI}$$

$$\boxed{\text{Power factor} = \frac{kW}{kVA}}$$

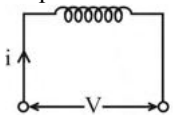
kW = Active power
kVA - Apparent power

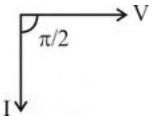
111. When an alternating supply is given to a purely inductive load:

(a) Both current and voltage are in same phase
(b) The voltage will lead the current by 135^0
(c) The current will lead the voltage by 90^0
(d) The voltage will lead the current by 90^0

NMRC Electronics 09.03.2017, 8:30 – 10:45 AM
Noida Metro Electronic JE 2017

Ans (d) : In pure inductive circuit -





Circuit -

From circuit = $V_m \sin \omega t$

Circuit current $(i) = \int di = \int \frac{V_m}{L} \sin \omega t dt$

$$= \frac{V_m}{L}\int \sin \omega t dt$$

$$= -\frac{V_m}{\omega L}\cos(\omega t) \quad = \frac{V_m}{\omega L}\sin\left(\omega t - \frac{\pi}{2}\right)$$

$$i = I_m \sin\left(\omega t - \frac{\pi}{2}\right)$$

Thus in a pure inductive circuit electric current lags voltage by 90^0.

112. When the frequency of applied voltage in a series RL circuit is increased, what happens to the inductive reactance?

(a) Increases (b) Decreases
(c) Remains the same (d) Becomes zero

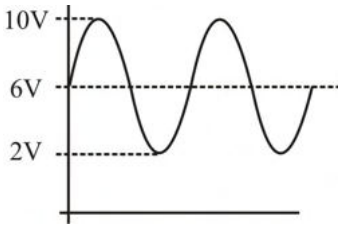
RRB JE- 01.09.2019

Ans. (a) : In RL series circuit, when the frequency of voltage is increased, the value of inductive reactance increases.

$$X_L = \omega L = 2\pi fL$$

$$\boxed{X_L \propto f}$$

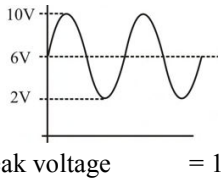
113. What is the peak-to-peak voltage of the waveform in the given circuit?



(a) 2V (b) 4V
(c) 6V (d) 8V

DMRC Electronic, 2015

Ans. (d) :



Upper Peak voltage = 10 – 6
= 4 V

Lower Peak voltage = 6 – 2
= 4 V

Peak to peak voltage = Upper peak voltage + Lower peak voltage
= 4 + 4 = 8 V

114. The standard frequency of AC supply in India is

(a) 25 Hz (b) 50 Hz
(c) 100 Hz (d) 1000 Hz

RRB SSE Secunderabad (Shift-I), 02.09.2015

Ans. (b) : As per Indian standard for our domestic power supply we used AC current, which is also known as alternating current, since they change its polarity at a certain interval of time.

- And we used 220V and 50 Hz power supply for our common domestic use.
- Where 220 V is potential difference and 50 Hz its frequency.

115. The r.m.s. value of the sine wave is 100A. its peak value is

(a) 70.7A (b) 141.4A
(c) 150A (d) 282.8A

RRB JE (Shift-I), 29.08.2015

Ans. (b) : Given that,

$I_{rms} = 100$ A

Peak value $(I_m) = \sqrt{2}\, I_{rms}$

$= 1.414 \times 100$

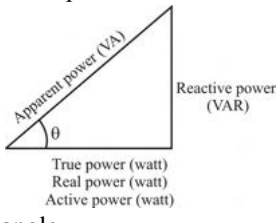
$= 141.4$Amp

116. The power factor is defined as the ratio……

(a) true power, apparent power
(b) apparent power, true power
(c) stored power, apparent lower
(d) true power, stored power

RRB SSE (shift-III), 02.09.2015

Ans. (a) : The power factor is defined as the ratio of true power, apparent power.



From power triangle -

$$\text{Power factor} = \frac{\text{Active power}}{\text{Apparent power}}$$

117. Which of the following is represented by the symbol X_L?

(a) Impedance of a load
(b) reactance of a coil
(c) resonant frequency of a filter
(d) output level of a source

RRB SSE (shift-III), 02.09.2015

Ans : (b) Reactance of a coil is represent by 'X_L'

Where, $X_L = \omega L\ \Omega$

$X_L = 2\pi fL$

118. The power of a single phase AC circuit is given by:

(a) VI (b) VI cos ϕ
(c) VI sin ϕ (d) None of these

RRB SSE Secunderabad Red Paper, 21.12.2014

Ans : (b) The power of a single phase AC circuit is given by VI.

Apparent power (S)-It is given by the product of rms value of applied voltage and circuit current.

$\boxed{S = VI}$ VA

$S = P + jQ$

Where, P = Active power in Watt

Q= Reactive power in VAR

$\boxed{P = VI\cos\phi}$ W

$\boxed{Q = VI\sin\phi}$ VAR

119. In A.C. circuit the product of voltage and current is known as :

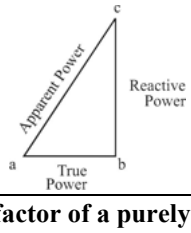
(a) Power (b) Real power
(c) Resistive power (d) Apparent power

RRB SSE (Shift-II), 01.09.2015

Ans : (d) Real power = VI cosϕ

Reactive power = VI sinϕ

Apparent power = VI



120. The power factor of a purely resistive circuit is:

(a) unity (b) 0.8 lagging
(c) 0.8 leading (d) zero

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (a) : The overall power factor is defined as the cosine of the angle between the phase voltage and phase current.

- In AC circuit, the power factor is also defined as the ratio of the real power flowing to the load to the apparent power in the circuit.
- Hence power factor can be defined as watts to volt-amperes.
- For a purely resistive circuit, the angle between the voltage and current is 0º.

So, power factor for purely resistive circuit is unity

p.f. = cos 0º

p.f. = 1(unity)

121. The peak value of a sine wave is 100 V. Its average value is

(a) 100 V (b) 50.5 V (c) 63.6 V (d) 74.7 V

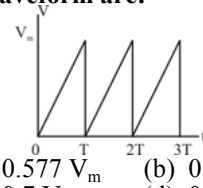
LMRC SC/TO Shift-2 J.E. 2016

Ans : (c) Maximum value of sinusoidal wave form = 100 volt

$V_m = 100V$

$$V_{av} = \frac{2V_m}{\pi} = \frac{2\times100}{3.14} = \frac{200}{3.14} = 63.6\text{ V}$$

122. The average and rms values, respectively, of the above waveform are:



(a) 0.5 V_m, 0.577 V_m (b) 0.1 V_m, 0.577 V_m

(c) 0.5 V_m, 0.7 V_m (d) 0.1 V_m, 0.7 V_m

LMRC SCTO (Electronics) 16.04.2018, Shift-II

Ans. (a) : For Sawtooth wave or triangular wave shape

Average value of voltage $V_{avg} = \frac{V_m}{2} = 0.5V_m$

RMS value of voltage $V_{rms} = \frac{V_m}{\sqrt{3}} = 0.577V_m$

123. The RMS value and mean value is the same in the case of-

(a) Sine wave

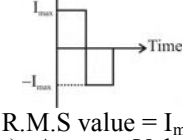
(b) Half wave rectified sine wave

(c) Triangular wave

(d) Symmetrical Square wave

RRB JE 31.08.2019

Ans. (d) : For symmetrical square wave the rms value and mean value both are equal.



R.M.S value = I_{max}

(Mean) Average Value = I_{max}

Wave Form	Max value	RMS Value	Average Value	Form Factor
Sinusoidal	A_m	$A_m/\sqrt{2}$	$\frac{2A_m}{\pi}$	1.11
Square	A_m	A_m	A_m	1
Triangular wave	A_m	$A_m/\sqrt{3}$	$\frac{A_m}{2}$	$\frac{2}{\sqrt{3}}$

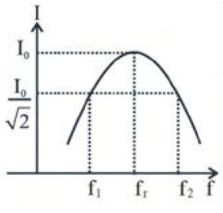
Square wave will have the highest RMS value.

124. The graph shows the resonance of a series RLC circuit. The X & Y axis respect are

(a) Voltage & Current
(b) Time & Current
(c) Frequency & Current
(d) Impedance & Current

LMRC SC/TO Shift-II J.E. - 2016

Ans. (c) : Resonance Curve - The curve between circuit current and the frequency of the applied voltage is known as resonance curve. The shapes of such a curve, for different values of R is given below.



$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

125. Higher the Q of a series circuit

(a) Broader its resonance curve
(b) Narrower its pass band
(c) Greater its band width
(d) Sharper its resonance

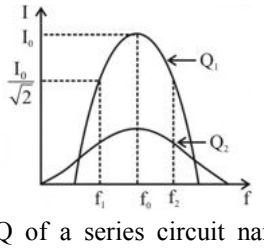
LMRC SC/TO Shift-2 J.E. 2016

Ans : (b) The quality factor Q is defined as the ratio of the resonant frequency to the bandwidth.

$$\text{Quality factor} = \frac{\text{Resonant frequency}}{\text{Bandwidth}}$$

- The quality factor is inversely proportional to the bandwidth.

$\boxed{Q_1 > Q_2}$



- Higher the Q of a series circuit narrower its pass band.
- Wider the bandwidth, less is the quality factor.

126. The purpose of parallel resonance circuit is to magnify

(a) Current (b) Voltage
(c) Power (d) Frequency

LMRC SC/TO Shift-2 J.E. 2016

Ans : (a) The purpose of parallel resonance circuit is to magnify current and series resonance circuit is to magnify voltage.

127. In a series R-L-C circuit, impedance at resonance is

(a) Unity (b) Maximum
(c) Infinity (d) Minimum

LMRC SC/TO Shift-2 J.E. 2016

Ans : (d) Series RLC circuit at resonance condition -

- Circuit impedance is minimum. $\Rightarrow Z = R$
- Circuit current is maximum. $\Rightarrow I_0 = \frac{V}{R}$
- Net reactance of the circuit is zero. $\Rightarrow X_L - X_C = 0$
- Power factor is unity.

128. Resonance is an electrical property used to describe:

(a) an inductor
(b) a set of parallel inductors
(c) the results of tuning a varicap (varactor)
(d) the frequency characteristic of a coil and capacitor circuit

RRB SSE (Shift-II), 03.09.2015

Ans (d) : Resonance is an electrical property used to describe the frequency characteristic of a coil and capacitor circuit.

$$\boxed{X_L = X_C}$$

$$2\pi f_r L = \frac{1}{2\pi f_r C}$$

$$\text{Resonance frequency}\left(f_r\right) = \frac{1}{2\pi\sqrt{LC}}$$

129. The power-factor at resonance in R-L-C circuit is

(a) Zero (b) Unity
(c) 0.5 lagging (d) 0.5 leading

RRB SSE (Shift-III), 01.09.2015

Ans : (b) The power factor at resonance in RLC circuit is unity.

$\Rightarrow$ $X_L = X_C$ (Resonance condition)

$$Z = \sqrt{R^2 + \left(X_L - X_C\right)^2}$$

$$Z = \sqrt{R^2 + 0^2}$$

$$\boxed{Z = R}$$

$$\text{Power factor } (\cos\phi) = \frac{R}{Z} = \frac{R}{R} = 1 \text{ (unity)}$$

130. For a series RLC circuit, R = 10Ω, L = 0.01 H and C = 100 μF. The bandwidth will be:

(a) 159 Hz (b) 78.58 Hz
(c) 238.73 Hz (d) 1 Hz

LMRC JE (S&T) 12.05.2018

Ans : (a) Given that, R = 10Ω, L = 0.01H, C= 100μF

$$\text{B.W.} = \frac{R}{2\pi L}\text{ Hz}$$

$$= \frac{10}{2\times 3.14\times 0.01} = \frac{500}{3.14} = 159.235\text{Hz}$$

$$\simeq 159 \text{ Hz}$$

131. The ratio of the resonant frequency to the bandwidth of a series resonant circuit is called:

(a) conductance (b) susceptance
(c) Q factor (d) selectivity

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (c) : The ratio of the resonant frequency to the bandwidth of a series resonant circuit is called Q-factor.

- Reciprocal of power factor is called the Q-factor of a coil.

$$\text{Q- factor} = \frac{\text{Resonant frequency}\left(f_0\right)}{\text{Bandwidth}\left(BW\right)}$$

$$\text{Q-factor} = 2\pi \frac{\text{maximum stored energy}}{\text{energy dissipated per cycle}}$$

$$\text{Q-factor} = \frac{1}{R}\sqrt{\frac{L}{C}}$$

132. At half power points of a resonance curve, the current is

(a) 2 times the maximum current

(b) $\frac{1}{2}$ times the maximum current

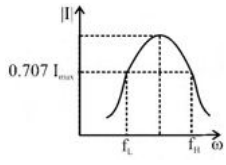
(c) 0.707 times the maximum current

(d) 1.414 times the maximum current

DMRC Electronics 11.04.2018, 12:15 - 2:30 PM

Ans. (c) : At half power points of a resonance curve, the current is 0.707 times the maximum current.

Important points related to half power point -



- Current = $\frac{I_{max}}{\sqrt{2}}$
- Impedance is $\sqrt{2}R$ or $\sqrt{2}Z_0$
- $P_1 = P_2 = \frac{P_0}{2}$
- The circuit phase angle is $\phi = \pm 45$

133. What is the expression for quality factor in terms of power?

(a) Ratio of power loss to power dissipated

(b) Ratio of stored power to power dissipated

(c) Ratio of power dissipated to power loss

(d) Ratio of power loss to power stored

RRB SSE Secunderabad Shift-1, 02.09.2015

Ans. (b) : Quality factor of an ac circuit is given by the ratio of the maximum electrical energy stored in the circuit to the energy dissipated per cycle.

$$Q = 2\pi \times \frac{\text{maximum energy stored}}{\text{Energy dissipated per cycle}}$$

- The quality factor can be defined for those circuits only that contain energy storing elements. In ac circuit there are two energy storing elements namely inductor and capacitor.

134. A series or parallel RLC circuit is said to be over damped if :

(a) $\alpha > \omega_n$ (b) $2\alpha = \omega_n$

(c) $\alpha < \omega_n$ (d) $\alpha = \omega_n$

DFCCIL EE 17.04.2016, Shift-II

Ans. (a) : For series RLC circuit -

$$\alpha = \frac{R}{2L}$$

For parallel RLC circuit

$$\alpha = \frac{1}{2RC}$$

For series or parallel RLC circuit

$$\omega_n = \frac{1}{\sqrt{LC}}$$

For over damped $\Rightarrow \alpha > \omega_n$

For critically damped $\Rightarrow \alpha = \omega_n$

For underdamped $\Rightarrow \alpha < \omega_n$

135. A coil has a resistance of 10 Ω and a time constant of 0.2 seconds. What will be the inductance of the coil?

(a) 2.5 H (b) 2 H
(c) 0.02 H (d) 50 H

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (b) : Given,
L = ? R = 10Ω τ = 0.2 Second

Time constant $\tau = \frac{L}{R}$

$L = R\tau = 10 \times 0.2 \Rightarrow L = 2$ H

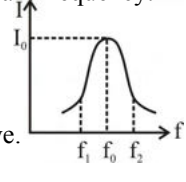
136. In a series RLC High Q circuit, the current peaks at a frequency.

(a) Equal to the resonant frequency
(b) Greater than the resonant frequency
(c) Less than the resonant frequency
(d) None of these

DMRC Electronic, 2015

Ans : (a) In a series RLC high Q-circuit, the current peaks at a frequency equal to the resonant frequency.

At



$f = f_0$
$V_L = V_C$
$X_L = X_C$

⇒ The nature of circuit will be resistive.
⇒ Phase angle is zero.
⇒ Current will be maximum.
⇒ Impedance will be minimum.
⇒ Power factor is unity.
⇒ Admittance will be maximum.

137. To increase Q factor of a coil, the wire must be-

(a) Thin (b) Thick
(c) Long (d) Long and thin

RRB JE Bhopal Paper-I (Shift-II), 28.08.2015

Ans : (b) Q-factor of a coil -

$$\text{Q-factor} = \frac{\omega_0 L}{R}$$

$$R = \rho\frac{\ell}{A}$$

$$R \propto \frac{1}{A} \propto \frac{1}{Q}$$

$$Q\uparrow \propto A\uparrow$$

⇒ To increase Q-factor of a coil, the wire must be thick.

138. Peak factor is also known as _____ factor.

(a) Amplitude (b) Phase
(c) Average (d) Form

UPPCL TG-2, 10.11.2023, Shift-I
NMRC Maintainer 14.09.2019
[DMRC Maintainer 10.04.2018, 9.00 -10:30 am]
[DMRC Maintainer 09.04.2018, 9.00 -10:30 am]

Ans : (a) The ratio of maximum value and rms value of alternating quantity is known as amplitude factor.

Formula $\boxed{\text{Peak factor} = \frac{\text{Maximum value}}{\text{RMS value}}}$

$$= \frac{I_{max}}{\frac{I_{max}}{\sqrt{2}}} = \sqrt{2} = 1.414$$

139. What is the power rating (kVA) in RL series circuit?

(a) Scalar sum of kW and kVAR
(b) Scalar difference of kW and kVAR
(c) Vector sum of kW and kVAR
(d) Product of kW and kVA

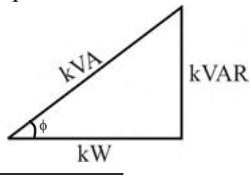
UPPCL TG-2, 09.11.2023, Shift-I
DMRC Maintainer 20.02.2020 (9.00-10.30)
ISRO Sriharikota Technician 29.04.2018

Ans. (c) : The power rating (kVA) in an RL series circuit is the vector sum of kW and kVAR

kW = Active power = VI cosϕ = P

kVAR = Reactive power = VI sinϕ = Q

kVA = Apparent power = VI = S



$$kVA = \sqrt{(kW)^2 + (kVAR)^2}$$

$$\boxed{\vec{S} = \vec{P} + j\vec{Q}}$$

140. Phase difference between any two phase of a balanced 3-Phase system is.....

(a) 180º (b) 360º
(c) 120º (d) 60º

UPPCL TG-2, 10.11.2023, Shift-I
UPPCL (TG-2) 17.11.2023, Shift-I
NPCIL Cat-II Electrician Maintainer-12.09.2021

Ans. (c) : Phase difference between any two phase of a balanced 3-Phase system is 120.

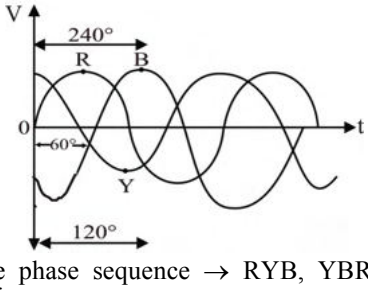
$$\theta = \frac{360}{n}$$

Where, n = 3, 4, 5,
n = No of Phase
for n = 3

$$\theta = \frac{360}{3} = 120^\circ$$

$$\boxed{\theta = 120^\circ}$$

- In a three-phase system, the order in which the voltages attain their maximum positive value is called phase sequence.
- Consider the R, Y and B the three phases of the supply system.



- Positive phase sequence → RYB, YBR, BRY → clockwise sequence
- Negative phase sequence → RBY, BYR, YRB → Anticlockwise sequence

141. Which condition is correct for resonance condition in an AC circuit?

(a) $X_L < X_C$ (b) $X_L > X_C$

(c) $X_L > X_C$ (d) $X_L = X_C$

UPPCL TG-2, 10.11.2023, Shift-I
UPPCL TG-2, 17.11.2023, Shift-I
NFL Electrician-18.12.2021, 4:00-6:00 PM

Ans. (d) : In an RLC series circuit for resonance condition $X_L = X_C$

- At series resonance, the impedance of the circuit is equal to the resistance

$$\boxed{Z = R}$$

- At resonance impedance is minimum and current will be maximum.

$$\boxed{I = \frac{V}{R}}$$

- At resonance condition power factor of circuit is unity.

142. The impedance of an RLC series circuit is .....

(a) $\left(R^2 + X_L^2 + X_C^2\right)^{1/2}$

(b) $\left(R^2 + X_L^2 - X_C^2\right)^{1/2}$

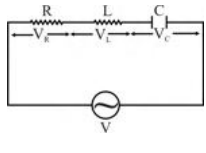
(c) $\left(R^2 + \left(X_L - X_C\right)^2\right)^{1/2}$

(d) $\left(R^2 + \left(X_L^2 + X_C^2\right)\right)^{1/2}$

UPPCL TG-2, 08.11.2023, Shift-I
ISRO Ahmedabad Technician 29.04.2018

Ans : (c) The impedance of RLC series circuit–

$$\boxed{Z = \sqrt{R^2 + \left(X_L - X_C\right)^2}}$$



where

X_L – Inductive reactance
X_C – Capacitive reactance

143. In series RLC circuit selectivity is defined as the ratio of -

(a) The cut-off frequency for the bandwidth
(b) Bandwidth to Resonance frequency.
(c) Resonance frequency to the bandwidth.
(d) Low end (cut-off) frequency for bandwidth.

UPPCL TG-2, 08.11.2023, Shift-I
UPPCL TG-2, 20.03.2021 Shift II

Ans. (c) : Selectivity of a series RLC circuit is defined as the ratio of resonance frequency to the half wave band width.

$$\text{Selectivity} = \frac{\text{resonance frequency}}{\text{bandwidth}}$$

$$\boxed{Q = \frac{f_r}{B.W}}$$

Where f_r = Resonance frequency
B.W. = Band width
Q = Quality factor.

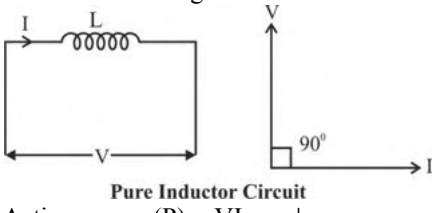
- Quality factor is proportional to selectivity.
- Quality factor measures by the quality of the coil.

144. Which of the following statements is correct for a pure inductor A.C. circuit?

(a) Apparent power is zero
(b) Reactive power is zero
(c) Active power is zero
(d) Impedance is zero

UPPCL (TG-2) 17.11.2023, Shift-I
ISRO Sriharikota Tech. 29.04.2018

Ans : (c) : In a pure inductor circuit, the active electric power is zero because there is a phase difference of 90^0 between the voltage and the current.



Pure Inductor Circuit

Active power (P) = VI cos ϕ

where ϕ angle between voltage and current

$P = VI \cos 90^0$

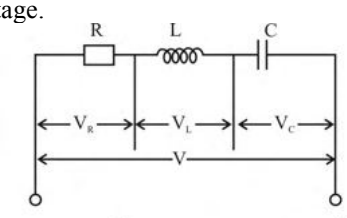
$\boxed{P = 0}$

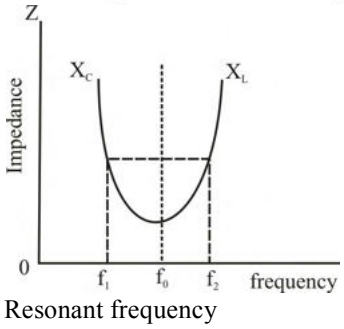
145. In a series RLC circuit that is operating above the resonant frequency, the current –

(a) Lags the applied voltage
(b) Leads the applied voltage
(c) Is in phase with the applied voltage
(d) Is zero

UPPCL TG-2, 08.11.2023, Shift-I
UPRVUNL-TG2 Instrumental-2015

Ans : (a) : In a series RLC circuit any frequency higher than resonant frequency, inductive reactance is larger than capacitive reactance and so the circuit behave as an inductive nature. The inductive circuit current lags the applied voltage.





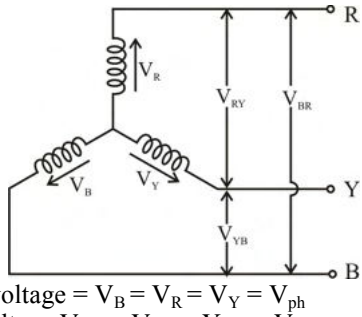
Where - f_0 - Resonant frequency
f_2 - Above resonant frequency
f_1 - Below resonant frequency

146. In a three-phase star-connected system, the voltage induced in each winding is called:

(a) potential voltage (b) residual voltage
(c) line voltage (d) phase voltage

UPRVUNL TG-2, 07.11.2023 Shift II
UPRVUNL TG-2, 15.07.2021 Shift II

Ans (d) : The voltage induced in each winding of a three-phase star connected system is called phase voltage.



- Phase voltage = $V_B = V_R = V_Y = V_{ph}$
- Line voltage $V_{BY} = V_{RB} = Y_{YB} = V_L$
- In star connection $\boxed{V_L = \sqrt{3}V_{ph}}$
- $\boxed{I_L = I_{ph}}$

147. Average power consumed by a purely inductive load is always ?

(a) infinite
(b) more than zero
(c) zero
(d) Less than infinity but greater than zero

JSSC Technician 19.09.2023
UPPCL TG-2, 27.03.2021 Shift II

Ans (c) : Average power consumed by a purely inductive load is always zero.

- If purely inductive load then average power.

$P = VI \cos\phi$

$P = VI \cos 90 \quad (\phi = 90^o)$

$\boxed{P = 0}$

148. Average value of current in an AC circuit with respect to its RMS value is always–

(a) More (b) Less
(c) Equal (d) Less than or equal

JSSC Technician 20.10.2023
(LMRC Maintainer Electrical Exam 2016)

Ans : (b) : Average value of current in an A.C. circuit with respect to its R.M.S. value is always less.

- R.M.S. value of current = 0.707 I_{max}
- While average value of current is 0.636 I_{max}

149. How many types of circuit there are normally-

(a) 10 (b) 5
(c) 7 (d) 8

MPESB Electrician-21.12.2022

Ans. (b) : Normally, there are five type of circuit.
1. Series circuit
2. Parallel circuit
3. Series-Parallel circuit
4. Star circuit
5. Delta circuit

150. In an RLC series circuit, the impedance 'Z' at resonance is equal to-

(a) 2R (b) R
(c) Infinity (d) 0
(e) 4R

JVVNL Technical Helper-02.11.2022, 12:00-14:00 PM

Ans. (b) : In an RLC series circuit, the impedance 'Z' at resonance is equal to R.

- **In series RLC circuit at resonance condition-**

$X_L = X_C$

Impedance (Z) = $\sqrt{R^2 + (X_L - X_C)^2}$

$= \sqrt{R^2 + 0}$

$\boxed{Z = R}$

■ **In series RLC circuit at resonance-**

Impedance	R (minimum)
Current	$I = \frac{V}{R}$ (Maximum)
Power factor	Unity (1)

151. The power curve for a purely resistive circuit is zero only when–

(a) Current is zero
(b) Voltage is zero
(c) Either current or voltage is zero
(d) None of these

Ordinance Factory ITI technician-17.01.2022

Ans. (c) : power in a circuit is the product of voltage, current and the cosine of the phase angle.

Power (P) = V.I. cos ϕ watt

■ Phase angle is zero in purely resistive circuits so Power (p) = VI
Hence if either voltage or current is zero, then the power will be zero.

152. In ac circuit the maximum current required is–

(a) Equal to effective current
(b) 1.414 time of the effective current
(c) Twice of the effective current
(d) 1.732 time of the effective current

Ordinance Factory ITI technician-17.01.2022

Ans. (b) : In the AC circuit the maximum current is 1.414 times of the effective current.

The relationship between the maximum value of current and the root mean square (RMS) value of current can be given by the formula,

$$\boxed{I_{max} = \sqrt{2}\ I_{rms}}$$

$$\boxed{I_{max} = 1.414\ I_{rms}}$$

■ For a sinusoidal waveform, the value of the crest factor is 1.414.
■ For a sinusoidal waveform, the RMS value of current will be 0.707 times the maximum value of current.

153. Admittance is the reciprocal of–

(a) inductive reactance
(b) capacitive reactance
(c) resistance (d) impedance

UPPCL TG-2, 09.11.2023, Shift-I
IOCL Technical Attendent-12.09.2022

Ans. (d) : Admittance is the reciprocal of impedance.

■ Susceptance is reciprocal of reactance.
■ Conductance is reciprocal of resistance.
■ Admittance is a measure of how easily a circuit or device will allow to flow current.

$$\boxed{Y = \frac{1}{Z}}$$

Where Y = Admittance
Z = impedance

154. Which one of the statements given below is correct?

1) Power factor can be one.
2) Power factor can be less than one
3) Power factor can be more than one
4) Power factor can be one or less than one

(a) 1, 2 and 4 are correct and 3 is wrong.
(b) 4 is correct and 1,2,3 are incorrect
(c) 2 and 3 are correct and 1, 4 are incorrect
(d) All are correct

CPRI ITI Electrician-19.12.2022, 9:00-10:30AM

Ans. (a) : Power factor : Power factor is defined as the cosine of the angle between the phase voltage and phase current.

- The value of power factor lies between 0 to 1. Maximum value of power factor is 1 and minimum value of power factor zero.
- **In AC circuit -**

$$\text{Power factor}(\cos\phi) = \frac{\text{Real Power}}{\text{Apparent Power}} = \frac{\text{Watt}}{\text{Volt} - \text{Ampers}}$$

- $\cos\phi = \frac{R}{Z}$
- Power factor is a unitless quantity.
- For a purely resistive circuit, the angle between the voltage and current is 0°.
  So power factor for a purely resistive circuit is Unity
- In a purely inductive circuit, the current lags the voltage by 90° and the power factor is zero lagging.
- In a purely capacitive circuit, the current leads the voltage by 90° and the power factor is zero leading.

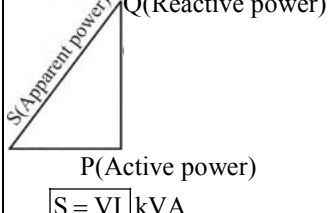
155. The power expressed in kVA is–

(a) Apparent power (b) Reactive power
(c) True power (d) Active power

UPPCL TG-2, 19.03.2021 Shift II

Ans : (a) The power expressed in kVA is apparent power. It is denoted by symbol (S).

$$S = \sqrt{(P)^2 + (Q)^2}$$



$S = VI$ kVA

$P = VI\cos\phi$ kW

$Q = VI\sin\phi$ kVAR

156. For Sine wave, RMS value =..... × maximum value.

(a) 0.707 (b) 0.635
(c) 0.859 (d) 1.732

NPCIL Cat-II Electrician Maintainer-12.09.2021

Ans. (a) : For Sine wave, RMS value = 0.707 x maximum value

$$\therefore \quad \text{RMS value} = \frac{\text{Maximum Value}}{\sqrt{2}}$$

- Hence, for a sinusoidal wave form, the R.M.S. value of current will be 0.707 times the maximum value of current.
- Form factor = $\frac{\text{R.M.S. Value}}{\text{Average Value}}$
- Peak factor = $\frac{\text{Maximum value}}{\text{R.M.S. value}}$
- For a sinusoidal waveform, the value of the crest factor is 1.41.

157. What is the Reactive power if the apparent power is 13 kVA and the active power is 12 kW?

(a) 5 kVAR (b) 1 kVAR
(c) 3 kVAR (d) 11 kVAR

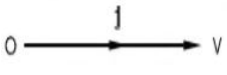
NFL Electrician-18.12.2021, 4:00-6:00 PM

Ans. (a) : Given
Active Power (P) = 12 kW
Apparent Power (S) = 13 kVA
Reactive Power (Q) = ?
We know that

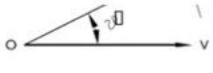
$$S = P + jQ$$
$$S = \sqrt{P^2 + Q^2}$$
$$13 = \sqrt{(12)^2 + Q^2}$$
$$(13)^2 = (12)^2 + Q^2$$
$$Q = \sqrt{25}$$
$$\boxed{Q = 5\text{kVAR}}$$

158. Which diagram is representing the zero power factor?

(a)

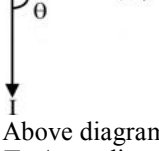
(b) 

(c)

(d) 

NFL Electrician-18.12.2021, 4:00-6:00 PM

Ans. (a) :



Above diagram is representing the zero power factor

- According to figure phase different between current and voltage is 90°.

$$\phi = 90$$

So power factor = cos ϕ

$$= \cos 90 \quad \boxed{=0}$$

159. Which of the following is shown the apparent power of three phase system?

(a) $\sqrt{3}$ VICosϕ (b) $\sqrt{3}$ VItanϕ

(c) $\sqrt{3}$ VI (d) $\sqrt{3}$ VIsinϕ

NFL Electrician-18.12.2021, 4:00-6:00 PM

Ans. (c) : The apparent power of three phase system is $\sqrt{3}$ VI.

- Active Power = $\sqrt{3}$ VI cos θ
- Reactive Power = $\sqrt{3}$ VI sin θ
- Unit of active power is kW.
- Unit of reactive power is kVAR.
- Unit of apparent power is kVA.

160. The RMS voltage of a sawtooth waveform can be obtained by multiplying peak voltage values by-

(a) 1 (b) $1\sqrt{2}$

(c) $\frac{1}{\sqrt{3}}$ (d) 1/3

(e) 1/2

JVVNL Technical Helper-27.08.2022,12:00-2:00PM

Ans. (c) : The RMS voltage of a sawtooth wave form can be obtained by multiplying peak voltage value by $\frac{1}{\sqrt{3}}$.

- For sawtooth waveform

$$V_{rms} = \frac{V_{max}}{\sqrt{3}}$$

- $$V_{average} = \frac{V_{max}}{2}$$

161. Which of the following is related to reactive power in an alternating current (AC) circuit?

(a) I^2R (b) VI

(c) VI cosϕ (d) VI sinϕ

UPPCL TG-2, 28.03.2021 Shift I

Ans : (d) P = VI sin ϕ is related to reactive power in an alternating current (AC) circuit the unit of reactive power is kVAR

- P = VI cos ϕ is related to active power in an alternating current (AC) circuit the unit of active power is kW.

162. When there is a phase difference of 90 degree between the current & voltage, the circuit will have

(a) Unity power factor

(b) Zero power factor

(c) Leading power factor

(d) Lagging power factor

UPPCL TG-2, 28.03.2021 Shift I

Ans : (b) When there is a phase difference of 90 degree between the current and voltage, the circuit will have zero power factor.

Power factor = cos ϕ

= cos 90 (ϕ = 90)

= 0

163. The power which moves in both the directions (forward and reversed) in the circuit is called as.

(a) Active power (b) Reactive power
(c) Apparent power (d) Complex power

UPPCL TG-2, 28.03.2021 Shift I

Ans : (b) The power which moves in both directions (forward and reversed) in the circuit is called reactive power.

- Reactive power (Q) = VI sin ϕ
- Unit of reactive power is kVAR.
- Active power (P) = VI cos ϕ
- Unit of active power is kW.
- Apparent power (S) = VI
- Unit of apparent power is kVA.

164. In three phase star- connected, four-wire system balanced load, current in Neutral is ___

(a) Less than phase current
(b) Equal to phase current
(c) More than phase current
(d) Zero

UPPCL TG-2, 03.11.2023 Shift II
UPPCL TG-2, 28.03.2021 Shift I

Ans : (d) In three phase star-connected , four-wire system balanced load, current in neutral is zero.

Connection	Relation between voltages	Relation between currents
Star (Y)	$V_L = \sqrt{3}\, V_{ph}$	$I_L = I_{ph}$
Delta (Δ)	$V_L = V_{ph}$	$I_L = \sqrt{3}\, I_{ph}$

165. Which parameter is not related to an AC circuit?

(a) RMS value
(b) Cultivation of wave
(c) Form Factor
(d) Peak to peak value

WBSETCL Technician-2023
UPPCL TG-2, 28.03.2021 Shift II

Ans (b) : Cultivation of wave is not related to an AC circuit.

- $\boxed{I_{rms} = \frac{I_{max}}{\sqrt{2}}}$
- $\boxed{I_{ave} = \frac{2I_{max}}{\pi}}$
- $\boxed{\text{Form factor} = \frac{\text{RMS value}}{\text{Average value}}}$

166. The tendency of which type of load is the output of the leading power factor?

(a) Capacitive
(b) Inductive
(c) Resistive
(d) Resistance and inductance are connected in series

UPPCL TG-2, 28.03.2021 Shift II

Ans (a) : In an AC system, when load current leads, the supply voltage, then the load is said to have a leading power factor. In practically the capacitive load cause a leading power factor.

- A leading power factor signifies that the load is capacitive as the load will deliver reactive power.

167. In a two phase system, the voltage varies up to _____

(a) 90^0 (b) 120^0
(c) 60^0 (d) 180^0

UPPCL TG-2, 19.03.2021 Shift II

Ans : (a) In a two-phase system, the voltage varies up to 90°.

- For 3 – ϕ system phase difference between phases is 120°.

168. An arc has a _____ power factor.

(a) 0.5 (b) Unity
(c) Zero leading (d) Zero lagging

UPPCL TG-2, 19.03.2021 Shift II

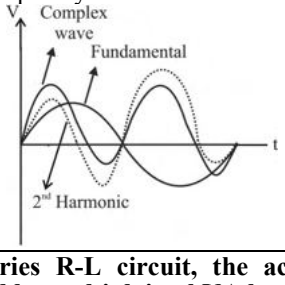
Ans : (b) An arc has a unity power factor. In the case of an arc, the current remains in phase with the voltage, due to which the nature of the arc behaves like a pure resistance therefore the power factor of the arc is unity.

169. The harmonics are present in _____

(a) Single phase AC circuit
(b) both, AC circuit and DC circuit
(c) DC circuit
(d) AC circuit

UPPCL TG-2, 19.03.2021 Shift II

Ans : (d) The harmonics are present in AC circuit. Harmonics are AC voltage and currents with frequencies that are integer multiples of the fundamental frequency.



170. In a series R-L circuit, the active power is obtained by multiplying kVA by _____

(a) $\frac{\pi}{2}$ (b) cos ϕ
(c) sin ϕ (d) $\frac{\pi}{6}$

UPRVUNL TG-2, 14.07.2021 Shift II

Ans. (b) : In a series R-L circuit, the active power is obtained by multiplying kVA by cos ϕ.

active power (P) = VI cos ϕ
Reactive (Q) = VI sin ϕ
Apparent power (S) = VI

171. In a circuit, the applied voltage is 100V and a current of 10A is found to be 30° lag. What is the value of P.F.?

(a) 0.5 lag (b) 0.5 lead
(c) 0.866 lag (d) 0.866lead

UPRVUNL TG-2, 14.07.2021 Shift II

Ans. (c) : Given

V = 100 volt, I = 10A, ϕ = 30º lag

Power Factor (P.f) = cosϕ

$= \cos 30^o = \frac{\sqrt{3}}{2}$

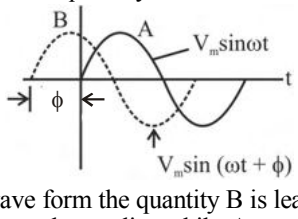
P.f = 0.866 lag

172. In phase difference _____alternating quantity is one that reaches its highest or zero value later than any other quantity.

(a) cosine (b) sinusoidal
(c) lagging (d) leading

UPRVUNL TG-2, 14.07.2021 Shift II

Ans. (c) : In phase difference, lagging alternating quantity is one that reaches its highest or zero value later than any other quantity.



In the above wave form the quantity B is leading i.e. it will reach its highest value earlier while A quantity is lagging i.e. it will reach its maximum or zero value later.

173. $(\text{Impedance})^2$ =?

(a) (resistance) + (reactance)
(b) (resistance) – (reactance)
(c) $(\text{resistance})^2 + (\text{reactance})^2$
(d) $(\text{resistance})^2 - (\text{reactance})^2$

UPRVUNL TG-2, 15.07.2021 Shift I

Ans (c) : $\text{Impedance}^2 = \text{Resistance}^2 + \text{Reactance}^2$

$$\boxed{Z^2 = R^2 + X^2}$$

$$\boxed{Z^2 = R^2 + (X_L \sim X_C)^2}$$

Where, X_L = Inductive reactance
X_C = Capacitive reactance
R = resistance
Z = Impedance

174. The RMS value of sinusoidal current in an AC circuit is equal to the angle?

(a) 45° (b) 60°
(c) 0° (d) 90°

UPRVUNL TG-2, 15.07.2021 Shift I

Ans (a) : The RMS value of sinusoidal current in an AC circuit is equal to the angle 45°.

$$i = I_m \sin\theta$$

$$I_{rms} = \frac{I_m}{\sqrt{2}}$$

$$I_m \sin\theta = \frac{I_m}{\sqrt{2}}$$

$$\sin\theta = \frac{1}{\sqrt{2}}$$

$$\boxed{\theta = 45^\circ}$$

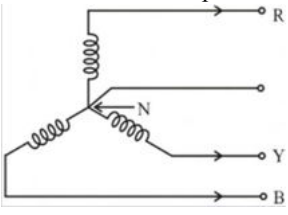
- Hence, In an AC circuit. The RMS value of a sinusoidal current is equal to its value at an angle of 45°.

175. In a three-phase star-connected system, point N is known as:

(a) Star point (b) Curie point
(c) Q-point (d) Nelson point

UPRVUNL TG-2, 15.07.2021 Shift II

Ans (a) : In a three-phase star-connected system, point N is known as star point or neutral point.



■ Star connection, $V_L = \sqrt{3}V_{ph}$

$I_L = I_{ph}$

Where,

V_L = Line voltage

V_{ph} = phase voltage

I_L= Line current

I_{ph}= phase current

176. Phasor from of alternating current Can be expressed in?

(a) Circular (b) Sinusoidal

(c) Rectangular (d) Triangular

UPRVUNL TG-2, 15.07.2021 Shift II

Ans (b) : Sinusoidal varying alternating current can be expressed in phasor from of alternating current.

177. The difference between the..... of two alternating quantities is called the phase difference.

(a) Time (b) Lengths

(c) Phase angle (d) Frequency

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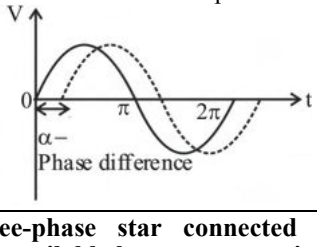
Ans (c) : The difference between the phase angle of two alternating quantities is called the phase difference.



178. In three-phase star connected system, the voltage available between any pair of terminals is called:

(a) potential voltage (b) phase voltage

(c) residual voltage (d) line voltage

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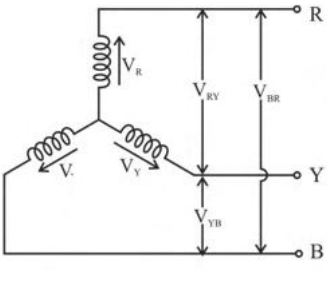
UPPCL TG-2 27/03/2021 Shift II

Ans (d) : In three-phase star connected system, the voltage available between any pair of terminals is called line voltage.



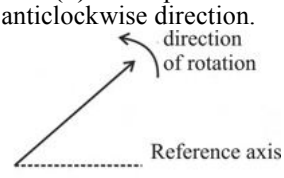
V_{BR}= V_{RY} =Y_{YB} = V_L = Line voltage.

179. The phasors are assumed to be rotated in the ..... direction.

(a) periodic (b) clockwise
(c) triangular (d) anticlockwise

UPRVUNL TG-2, 15.07.2021 Shift II

Ans (d) : The phasors are assumed to be rotated in the anticlockwise direction.



Phasor representation

- A phasor is a straight line marked with an arrow at one end.
- The length of the phase represents the magnitude while the arrow head represents the direction.
- The length of the phasor is the r.m.s. of the sinusoidal quantity.
- The speed of rotation of the phasor is expressed in radians/second.

180. Active power is measured in .....

(a) V (b) kW
(c) VAR (d) VA

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (b) : Active power is measured in kilowatt and this is called watt full power.

Active Power $\boxed{P = VI\cos\theta}$ kW

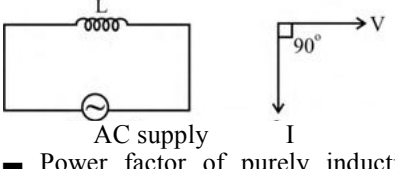
- Unit of apparent power - VA.
- Unit of reactive power- VAR.

181. With reference to the voltage, the current in an inductive current is .....

(a) leading (b) in phase
(c) lagging (d) out o phase

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (c) : Taking voltage as reference in inductive circuit then current is in lagging nature.



- Power factor of purely inductive circuit is zero legging.
- Power factor of purely capacitive circuit is zero leading.
- Power factor of purely resistive circuit is unity.

182. The power consumed for a balanced load in star and delta- connected is .....

(a) $\sqrt{3}V_P V_P \cos\theta$ (b) $3\ V_L I_L \cos\theta$
(c) $3\ V_P I_P \cos\theta$ (d) $2\ V_L I_L \cos\theta$

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (c) : For a balance load in star and delta connection are consumption power $P=3V_P I_P \cos\theta$ watt.

V_P = phase voltage

I_P = phase current

$\cos\theta$ = Power factor

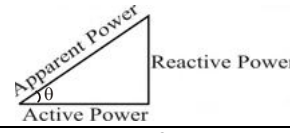
$P = \sqrt{3}\ V_L\ I_L \cos\theta$

V_L = line voltage

I_L = Line current

$\cos\theta$ = Power factor

Power factor ($\cos\theta$) = $\frac{R}{Z} = \frac{\text{Active Power}}{\text{Apparent Power}}$



183. The phase current of a star connected, 3-phase circuit is 100A. The line current will be .....

(a) 300 A (b) 100 A
(c) 173 A (d) 57.8 A

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (b) : Given,

I_P=100A I_L=?

∵ **In star connection**

$\boxed{I_L = I_P}$

$\boxed{V_L = \sqrt{3}V_{ph}}$

∴ $I_P = I_L = 100A$

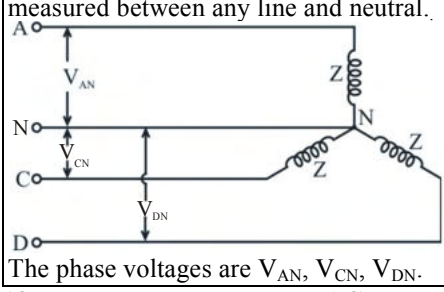
$\boxed{I_L = 100A}$

184. What is means of phase voltage?

(a) It is the voltage across the phases A, B or C and the neutral conductor N.
(b) It is the voltage across the phases A & B, B & C and C & A.
(c) It is the voltage measured between two lines or conductors of single phase alternator.
(d) It is the voltage which is always in phase with the current.

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (a) :Phase voltage:- phase voltage is the voltage measured between any line and neutral.



The phase voltages are V_{AN}, V_{CN}, V_{DN}.

185. What do all standard AC meters indicate?

(a) Peak value
(b) Square root mean square
(c) Average value
(d) Maximum value

UPPCL TG-2, 27.03.2021 Shift II

Ans (b) : All standard AC meters indicate the root mean square value (RMS value).

186. What will be the power factor when the current and voltage are in phase?

(a) Zero (b) Unity
(c) Lagging (d) Leading
(e) Neither (c) nor (d)

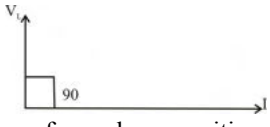
JVVNL Electrician Helper III, 23.08.2018 Shift I

Ans. (b) If current and voltage are in phase then the power factor will be unity.

power factor = $\cos\phi = \cos 0$ ($\phi = 0$)

Power factor = 1

- Power factor of purely inductive circuit is zero legging.



- Power factor of purely capacitive circuit is zero leading.

187. A series RLC circuit at the resonance frequency then pure reactance is _____.

(a) Capacitive (b) Inductive
(c) Zero (d) One
(e) Infinite

UPPCL (TG-2) 10.11.2023, Shift-II
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Ans. (c) A series RLC circuit at resonance frequency then pure reactance is zero.

- at resonance condition -

$X_L - X_C = 0$

$X_L = X_C$

$\boxed{Z = R}$

- Power factor unity

$$\cos\phi = \frac{R}{Z} \quad (R = Z)$$

$$\cos\phi = \frac{Z}{Z} = 1$$

$$\boxed{\cos\phi = 1}$$

Resonance frequency $f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC}}$

188. The ratio of RMS value and average value of AC is called ?

(a) Peak factor (b) Power factor
(c) Average factor (d) Potential factor
(e) Form factor

RSMSSB Instructor (wireman) 24.03.2019
JVVNL Electrician Helper III, 23.08.2018 Shift III

Ans. (e) The ratio of RMS value and Average value of AC is called form factor.

$$\boxed{\text{Form factor} = \frac{\text{RMS value}}{\text{Average value}}}$$

- Form factor for sine wave is 1.11.
- Peak factor for sine wave is 1.41.

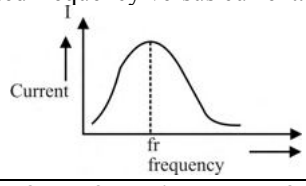
$$\boxed{\text{Peak factor} = \frac{\text{Max value}}{\text{RMS value}}}$$

189. The resonance curve for a series resonance circuit is plotted frequency versus .....

(a) Voltage (b) Impedance
(c) Electric current (d) Reactance
(e) Elastance

JVVNL Electrician Helper III, 23.08.2018 Shift III

Ans. (c) The resonance curve for a series resonant circuit is plotted frequency versus current.



190. Which of the following type of load has zero power factor.

(a) Pure capacitive load (b) Pure inductive load
(c) both a and b (d) only resistive load
(e) both a and d

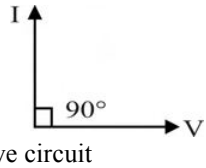
JVVNL Electrician Helper III, 24.08.2018 Shift II

Ans. (c) : Purely inductive and purely capacitive load has zero power factor.

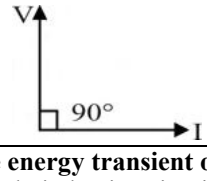
Power factor = cos ϕ
= cos 90 (ϕ = 90°)

$$\boxed{\text{Power factor} = 0}$$

■ Purely capacitive circuit



■ Purely inductive circuit



191. The double energy transient occur in the ____?

(a) in a purely inductive circuit
(b) R-L circuit
(c) R-C circuit
(d) R-L-C circuit
(e) L-C circuit

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Ans. (d) : Double energy transient occurs in the RLC circuit. Because both L and C are energy storing element in this circuit.

Storage energy in inductor (U) = 1/2 LI^2
Storage energy in capacitor U = 1/2 CV^2

192. The quality factor also know as _____

(a) Voltage magnification
(b) Current magnification
(c) Resistance magnification
(d) Impedance magnification
(e) Inductance magnification

JVVNL Electrician Helper III, 24.08.2018 Shift III

Ans. (a) : Quality factor also know as voltage magnification for RLC series resonance circuit.

$$\text{Quality factor (Q)} = \frac{\omega L}{R}$$

■ The voltage across the capacitor or inductor in resonance condition is equal to Q time the source voltage.

$$\boxed{\text{Quality factor} = \frac{V_L \text{ or } V_C}{V}}$$

193. The load consumes the entire energy supplied by the source when the power factor is?

(a) 0 (b) 0.5
(c) 0.8 (d) 1
(e) None of these

JVVNL Electrician Helper III, 25.08.2018 Shift I

Ans. (d) : The load consumes the entire energy supplied by the source when the power factor is one.

194. In a DC circuit, what would be the inductive Reactance?

(a) Same as in the case of AC circuit
(b) High
(c) Very high
(d) Zero
(e) Unity

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Ans. (d) : Inductive reactance is denoted by X_L.

$X_L = 2\pi fL$

- In a DC circuit, the value of frequency (f) is zero.

$X_L = \omega L = = 2\pi fL = 0$

195. While drawing a vector diagram for a series circuit, the reference vector is .....?

(a) Voltage (b) Current
(c) Power (d) Phase angle
(e) Resistance

JVVNL Electrician Helper III, 25.08.2018 Shift II

Ans. (b) : While drawing vector diagram for a series circuit, the reference vector is current.

- In any series circuit with combinations of RC, RL, RLC connected in series, the current across all the elements is the same. Since the current is the common factor, it is considered as reference vector.

196. At resonance frequency, the inductive reactance value is equal to _____

(a) Resistance of circuit
(b) Reactance of winding
(c) Reactance of the capacitor
(d) Impedance of circuit
(e) Conductivity of winding

JVVNL Electrician Helper III, 25.08.2018 Shift III

Ans. (c) : At resonance frequency the inductive reactance is equal to reactance of the capacitor (180° out of phase). $\boxed{X_L = X_C}$

Series Resonance Circuit	Parallel Resonance Circuit
Impedance is minimum (Z=R)	Impedance is maximum $Z = \frac{L}{CR}$
The value of current is maximum. $\uparrow I = \frac{V}{Z\downarrow}$	The value of current is minimum $\downarrow I = \frac{V}{Z\uparrow}$
Admittance is maximum	Admittance is minimum.
The value of power factor is unity at series resonance condition.	The value of power factor is unity at parallel resonance condition.
Series resonance circuit is voltage magnifier circuit.	It is current magnifier circuit.

197. The polarity of the AC wave form reverses every -_____ cycle.

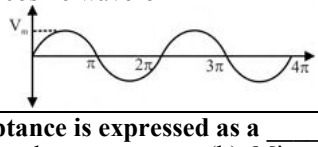
(a) half (b) one
(c) two (d) three
(e) none of these

JVVNL Electrician Helper III, 25.08.2018 Shift III

Ans. (a) : The polarity of the AC wave form reverses every half cycle.

- **AC waveform :** The wave form whose magnitude changes at every instant of time is known as the AC wave form.
- The Polarity of the AC wave form reverses every half cycle.

Ex. : Sine or cosine waveform



198. Susceptance is expressed as a _____ word.

(a) Farads (b) Micro-farads
(c) Ohms (d) Siemens
(e) Henry

JVVNL Electrician Helper III, 25.08.2018 Shift III

Ans. (d) : Susceptance is expressed as a siemens word. The susceptance (B) is the imaginary Part of admittance.

- The admittance is the reciprocal of impedance.

$$Y = G + jB$$

Where

Y = Admittance
G = conductance (Real Part)
B = Susceptance (Imaginary Part)

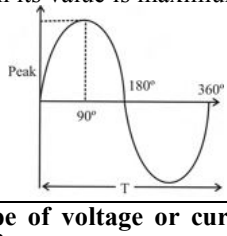
- Siemens is the SI unit of susceptance.

199. When is the positive maximum of a sine wave ?

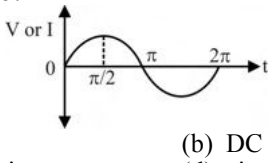
(a) 0° (b) 90°
(c) 180° (d) 45°
(e) 270°

JVVNL Electrician Helper III, 27.08.2018 Shift I

Ans. (b) In Alternating current the current wave is at an angle of 90° when its value is maximum.



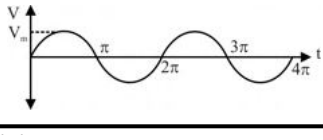
200. Which type of voltage or current is shown in the figure?



(a) AC (b) DC
(c) Pulsating (d) circular
(e) Square

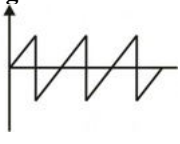
JVVNL Electrician Helper III, 27.08.2018 Shift II

Ans. (a) : The given figure shows alternating current (A.C.)

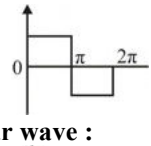


- The quantity whose magnitude and direction change after a certain time is called alternating quantity (A.C.).
- There are many types of electric waves according to the shape.

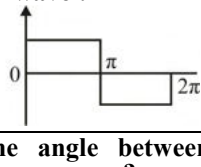
(i) Triangular wave :



(ii) Square wave :



(iii) Rectangular wave :



201. The cosine angle between the voltage and current is _____?

(a) Real Power (b) Power factor
(c) Real Power (d) Power
(e)Voltage

JVVNL Electrician Helper III, 27.08.2018 Shift III

Ans. (b) : The cosine of angle between voltage and current in an AC circuit is known as power factor.

- The term cos ϕ is called the power factor of the circuit.

(i) $\cos\phi = \frac{\text{Real Power}}{\text{Apparent Power}}$ (ii) $\cos\phi = \frac{R}{Z}$

202. Formula for Inductive reactance (X_L) is given by _____?

(a) $\frac{1}{2nfC}$ (b) $2\pi fL$
(c) $\frac{1}{2\pi fL}$ (d) $2nfC$
(e) $2fL$

JVVNL Electrician Helper III, 27.08.2018 Shift III

Ans. (b) An A.C. Inductive reactance (X_L) of the circuit is

$$\boxed{X_L = 2\pi fL}$$

- Capacitive reactance

$$\boxed{X_C = \frac{1}{\omega C} = \frac{1}{2\pi fC}}$$

Where

f = frequency
L = Inductance

203. What will be the impedance of a parallel resonant circuit at the resonant frequency?

(a) Maximum (b) Minimum
(c) Zero (d) Unity
(e) either (a) or (b)

JVVNL Electrician Helper III, 27.08.2018 Shift III

Ans. (a) : The impedance of a parallel resonant circuit will be maximum at the resonant frequency.

(i) Parallel R.L.C. circuit at resonant frequency-

- Impedance is maximum so current will be minimum.

- Effective impedance = $\frac{L}{CR}$
- Power factor is unity.
- It is current magnifier circuit (band stop filter)

(ii) Series R.L.C. circuit at resonant frequency-

- Impedance is minimum so current is maximum
- Effective resistance = R
- Power factor is unity
- It is voltage magnifier circuit (band pass filter)

204. In a three phase delta connection, line voltage is ------- times of phase voltage?

(a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$
(c) 1 (d) 2
(e) 3

UPPCL (TG-2) 17.11.2023, Shift-II
JVVNL Electrician Helper III, 29.08.2018 Shift II

Ans. (c) : In a three phase delta connection, line voltage is equal to phase voltage.

- Delta connection : $V_L = V_{Ph}$ $I_L = \sqrt{3}I_{ph}$
- Star connection $V_L = \sqrt{3}V_{ph}$ $I_L = I_{ph}$
- Delta connection in a three-phase system is formed by connecting one end of the winding to the starting end of other winding and the connection are continued to form a closed loop.

205. The power factor of an A.C. circuit lies between

(a) 0 and 1 (b) -1 and 0
(c) 0 and -1 (d) greater than 1

TRANSCO JLM-11.02.2018
Bihar TG -2, 03.11.2018, [Batch-1]

Ans. (a) : Power factor is the cosine of the angle between the voltage and current in A.C. circuit.

- The value of power factor lies between 0 to 1.
- Power factor is unitless quantity.

206. A spark is generated when a load is switched off. Because there is a high..... in the circuit.

(a) Impedance (b) Inductance
(c) Capacitance (d) Resistance

PGCIL Tech. 14.11.2018

Ans : (b) : A spark occurs when a load is switched off because of the high inductance in the circuit.
Energy is store in inductor, when the load is switched off, due to the stored energy, the supply current keeps flowing in it, i.e. the current does not suddenly become zero, due to which sparking occurs.

207. What are the three basic electrical quantities?

(a) Resistance, Capacitance, Inductance
(b) Power, Voltage, Conductance
(c) Voltage, Current, Resistance
(d) Current, Reluctance, Inductance

Ordnance Factory Paper–I, 2017

Ans : (c) : The three basic electrical quantities are voltage, current and resistance.

208. Inductor and capacitor do not allow sudden change in .....

(a) Voltage and current respectively
(b) Current and current respectively

(c) Voltage and voltage respectively
(d) Current and voltage respectively

MP Line Attendant 24.07.2018

Ans : (d) : Inductor and capacitor do not allow sudden changes in current and voltage respectively.
- Inductor stores energy in electro magnetic form and opposes sudden change in current.
- Capacitor stores energy in the form of electric field and oppose sudden change in voltage.

209. The Unit of impedance is–
(a) Henry
(b) Watts
(c) Ohm
(d) Being a ratio, no units

ISRO Ahmedabad Technician 29.04.2018

Ans : (c) The unit of impedance is Ohm.
- The unit of inductor is Henry.
- The unit of Active power is Watt.
- The unit of capacitor is Farad.

210. The active power in a series R-C circuit is–
(a) Zero (b) Positive
(c) Negative (d) None of these

Ordnance Factory Paper-I, 2017

Ans (b) : The active power in a series R-C circuit is positive.
- The active power in a pure inductive and pure capacitive circuit is zero.
- The reactive power in a pure resistive circuit is zero.

211. The electric current that changes periodically is called?
(a) Direct current (b) Thermal current
(c) Oscillating current (d) Alternating current

PGCIL Tech. 14.11.2018

Ans : (d) : The electric current whose magnitude and direction keep changing with time is called alternating current while the magnitude and direction of direct current does not change with time i.e. it remains constant.

212. The voltage rating of single phase domestic appliances in India generally lies within the range of .....
(a) 150–175V (b) 400–440V
(c) 220–250V (d) 100–120V

DMRC Maintainer 19.02.2020 (9.00-10.30)

Ans. (c) : The voltage rating of single phase domestic appliances in India is generally in the range of 220-250 Volt.
- The standard frequency of India is 50Hz.

213. If the power factor of a circuit is unity, then its reactive power is :
(a) Negative quantity (b) Minimum
(c) Equal to I^2R (d) Zero

DMRC Maintainer 17.02.2020 (9.00-10.30)

Ans (d) : If the power factor of a circuit is unity, then its reactive power is zero.
- If the power factor of a circuit is zero, then its active power is zero.

214. In India, mains Supply Voltage used for domestic electric appliances is_____Volt.
(a) 110 (b) 48
(c) 220 (d) 5

NPCIL (STM) 03.12.2019

Ans. (c) : The mains supply voltage used for domestic electrical appliances in India is 220 Volt. The frequency of voltage used for domestic electrical appliances in India is 50 Hz.

215. Power factor of an AC circuit is_____, where θ is phase angle.

(a) sinθ (b) cosθ
(c) tanθ (d) cotθ

NPCIL (STM) 03.12.2019

Ans. (b) : Power factor of an A.C. circuit is cosθ, where θ is phase angle.

Power factor– In an A.C. circuit, the cosine of the angle formed between voltage and current is called power factor.

- The ratio of resistance and impedance in A.C. circuit is called power factor

$$\boxed{\cos\theta = \frac{R}{Z}}$$

- The ratio of active power and apparent power is also called power factor.

$$P.F = \frac{VI\cos\theta}{VI}$$

$$\boxed{PF = \cos\theta}$$

216. For sin wave, RMS value = _____× maximum value.

(a) 0.707 (b) 0.635
(c) 0.859 (d) 1.732

NPCIL (STM) 03.12.2019

Ans. (a) : For sin wave, RMS value = 0.707 × maximum value.

For sin wave RMS value–

$I_{rms} = 0.707 \times$ maximum current (I_m)

$V_{rms} = 0.707 \times V_m$

Avg. value–

$$I_{avg} = 0.636 \times I_m$$

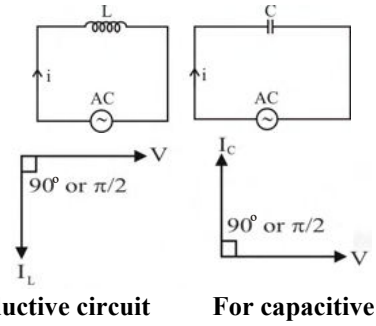
$$V_{avg} = 0.636 \times V_m$$

217. If the circuit contains only an inductor or capacitor, then the phase difference between voltage and current is-

(a) $\frac{\pi}{4}$ (b) π
(c) $\frac{\pi}{2}$ (d) 2π

RSMSSB Instructor (Electrician) 24.03.2019

Ans. (c) :



For inductive circuit **For capacitive circuit**

It is clear from the above diagram that if there is only inductor or capacitor in the circuit then the phase difference between current and voltage will be $\pi/2$.

218. How the inductive reactance changes as the frequency of AC voltage applied across the inductive load increases?

(a) Increases linearly
(b) Decreases linearly
(c) Remains the same
(d) Increases proportional to the square of the frequency

ISRO DT. 10.02.2019

Ans : (a) : The inductive reactance (X_L) increasing linearly with increasing frequency of the A.C. voltage applied across the inductive load.

$$X_L = 2\pi fL$$

$$\boxed{\uparrow X_L \propto f \uparrow}$$

219. In a three phase supply, the phase angle between the phases are :

(a) 120° (b) 90°
(c) 270° (d) 180°

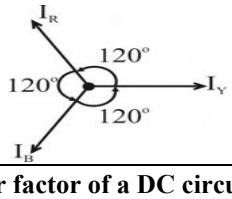
ISRO DT. 10.02.2019
NPCIL (STM) 03.12.2019

Ans : (a) : In a three phase supply, the phase angle between the phases are 120°.

Formula–

$$\theta = \frac{360}{n} = \frac{360}{3} = 120^\circ$$

$$\boxed{\theta = 120^0}$$



220. The power factor of a DC circuit is

(a) Unity (b) Zero
(c) Less than unity (d) Greater than unity

(ISRO DT. 24.03.2019)

Ans. (a) : The power factor of a D.C. circuit is unity. Because in the case of D.C., the value of both capacitive reactance (X_C) and inductive reactance (X_L) is negligible.

Hence, $\boxed{Z = R}$

$$\text{Power factor } (\cos\phi) = \frac{R}{Z}$$

$$\boxed{\cos\phi = \frac{R}{R} = 1(\text{unity})}$$

221. What is the crest factor of an alternating current (AC) of a sinusoidal wave?

(a) 11.1 (b) 1.414
(c) 1.11 (d) 14.14

UPPCL TG-2 (Date : 25-01-2019) Shift-I
IOF Paper–I, 2017

Ans : (b) The crest factor of an alternating current (A.C) of a sinusoidal wave is 1.414.

Wave	Peak factor / crest factor $= \frac{\text{Maximum Value}}{\text{R.M.S. Value}}$	Form factor $= \frac{\text{R.M.S. Value}}{\text{Average Value}}$
Sinusoidal	1.414	1.11
Square shape	1	1
Triangular Wave	1.732	1.16
Half wave	2.0	1.57

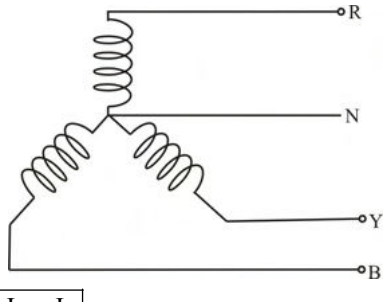
222. What is the current in the neutral wire of an un-balanced star-connected circuit?

(a) $I_N = I_R - I_Y + I_B$ (b) $I_N = I_R - I_Y - I_B$

(c) $I_N = I_R + I_Y + I_B$ (d) $I_N = I_R + I_Y - I_B$

UPPCL TG-2 (Date : 25-01-2019) Shift-I

Ans : (c) In unbalanced condition the neutral current is the algebraic sum of I_R, I_Y and I_B.



$$I_N = I_R + I_Y + I_B$$

- But in balanced condition the value of neutral current is zero.

223. In which of the following methods, a three phase supply can be connected to another three phase supply as well as a single phase supply?

(a) In star connection

(b) In delta connection

(c) In static condenser

(d) In synchronous induction motor

[DMRC Maintainer 11.04.2018]

Ans. (a) : In star connection; a three phase supply can be connected to another three phase supply as well as a single phase supply.

Stare connection–

Line voltage (V_L) = $\sqrt{3}$ × phase voltage (V_{ph})

Line current (I_L) = phase current (I_{ph})

Delta connection–

Line voltage (V_L) = phase voltage (V_{ph})

Line current (I_L) = $\sqrt{3}$ × phase current (I_{ph})

224. The maximum value of E.M.F. or electric current of an A.C. in one cycle is called .....

(a) RMS value (b) Average value

(c) Peak factor (d) Peak value

[DMRC Maintainer 13.04.2018, 9 -10:30 am]

Ans. (d) : In one cycle, the highest value of EMF or electric current of an A.C. is called peak value. It is also known as crest value, peak value, Amplitude etc.

$$V_{max} = \sqrt{2}\ V_{rms} = \frac{\pi}{2} V_{avg} \text{ volt}$$

$$I_{max} = \sqrt{2}\ I_{rms} = \frac{\pi}{2}\ I_{avg} \text{ Amp.}$$

225. Identify the one of the following methods which is capable of supplying only three phase load?

(a) Star connection
(b) Both star and delta connection
(c) Inter star connection
(d) Delta connection

[DMRC Maintainer 17.04.2018, 9.00 -10:30 am]

Ans. (d) : Delta connection is capable of supplying three phase load.

- In delta connection, the value of line voltage and phase voltage are equal.

$$V_L = V_{ph}$$

- Line current is equal to $\sqrt{3}$ times of phase current.

$$I_L = \sqrt{3}\ I_{ph}$$

226. What is the meaning of line voltage?

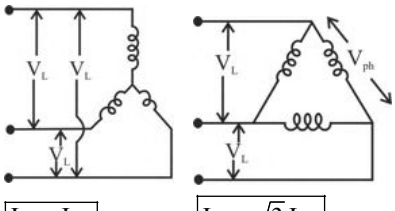
(a) Available voltage between three phases
(b) Voltage available between phase and neutral
(c) Voltage available between ground and neutral
(d) Voltage available between any two phases

ALP, Technician 22.01.2019, [12:30-03:00]

Ans. (d) : Voltage available between any two phases is called line voltage.

- Voltage available between phase and neutral is called phase voltage.

Star connection Delta connection



$I_L = I_{ph}$ $I_L = \sqrt{3}\, I_{ph}$

$V_L = \sqrt{3} V_{ph}$ $V_L = V_{ph}$

V_L = Line voltage
V_{ph} = Phase voltage

227. To find the actual power, the apparent power multiply by.....

(a) Resonant frequency
(b) Measuring factor
(c) Supply factor
(d) Power factor

ALP, Technician 22.01.2019, [12:30-03:00]

Ans. (d) : To find the actual power, the apparent power multiply by power factor.

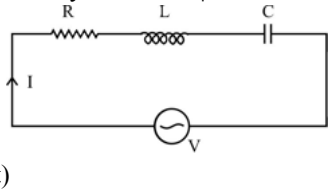
- Actual power = apparent power × cos ϕ
  = VI cos ϕ
- Reactive power = VI sine ϕ
- The unit of reactive power is kVAR.
- Apparent power = VI
- Unit of apparent power is kVA.

228. The power consumed in an RLC series circuit can be calculated by which of the following formula?

(a) P = IR cos ϕ (b) P = IR
(c) P = VI cos ϕ (d) P = VI

ALP, Technician 23.01.2019, [04:30-07:00]

Ans. (c) : The power consumed in an RLC series circuit can be calculated by P = VIcosϕ.



(RLC circuit)

$$\text{Power consumed}\left(P\right) = VI\cos\phi$$

$$\boxed{P = VI\cos\phi}$$

229. The inductive and capacitive reactances of an AC circuit are rated in _____.

(a) Volt ampere reactive (VAR)
(b) Amperes
(c) Ohms
(d) Watt

ALP, Technician 22.01.2019, [08:30-11:00]

Ans. (c) : The inductive and capacitive reactance of an A.C. circuit are measure in ohms.

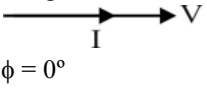
- Watt is the unit of power.
- Amperes is the unit of current.
- VAR is the unit of reactive power.

230. The instantaneous voltage across a pure resistor is _____ with current

(a) out of phase (b) lags
(c) in-phase (d) leads

ALP, Technician 22.01.2019, [04:30-07:00]

Ans. (c) : The instantaneous voltage across a pure resistor is in phase with current.



ϕ = 0º

- Power factor of purely resistive circuit is unity.

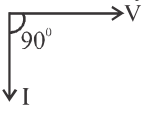
Power factor = cos ϕ
= cos 0º (ϕ = 0°)
= 1

231. In a pure inductor the voltage waveform "leads" the current by

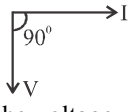
(a) 180° (b) 60°
(c) 90° (d) 120°

ALP, Technician 22.01.2019, [04:30-07:00]

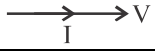
Ans. (c) : In a pure inductor the voltage waveform leads the current by 90 degree.



- In a pure capacitor the voltage wave form laggs the current by 90 degree.



- In a pure resistor the voltage waveform in phase the current.

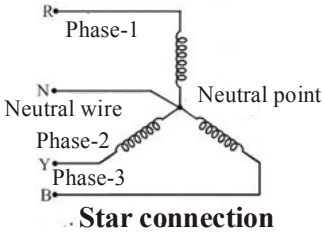


232. In which of the following connections do we have common neutral point?

(a) Star (b) Omega
(c) Sigma (d) Delta

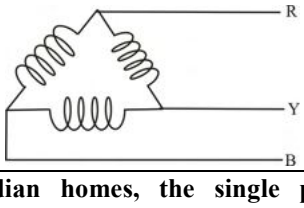
ALP, Technician 23.01.2019, [12:30-03:00]

Ans. (a) : In a star connection do we have common neutral point.



Star connection

In a delta connection to we have not common neutral point.



233. In Indian homes, the single phase supply voltage is happens in the form of–

(a) D.C. voltage
(b) Pulsed voltage
(c) RMS voltage
(d) Peak to peak voltage

ALP, Technician 23.01.2019, [08:30-11:00]

Ans. (c) : In Indian homes, the single phase supply voltage is happens in the form of RMS voltage.

- RMS (Root mean square) of sine wave is

$$V_{r.m.s} = \frac{V_{max}}{\sqrt{2}}$$

- Average value = $\frac{2V_m}{\pi}$ (for sine wave).

234. At high frequency, value of inductive reactance :

(a) Increases
(b) Decreases
(c) Remains the same
(d) Depend upon voltages

DMRC Maintainer Electrician 2017

Ans : (a) At high frequency, value of inductive reactance increases. Because

$$X_L = 2\pi fL$$

$$\uparrow X_L \propto f \uparrow$$

- At high frequency, the value of capacitive reactance decreases

$$X_C = \frac{1}{2\pi fC}$$

$$\downarrow X_C \propto \frac{1}{f \uparrow}$$

235. The electric current flowing in a circuit is the ____:

(a) Random movement of the electrons
(b) Movement of free electrons in one direction
(c) Potential difference of the conductors used
(d) Cross- section of the conductors used

DMRC Maintainer Electrician 2017

Ans : (b) The electric current flowing in a circuit is the movement of free electrons in one direction.

- In a electric current flowing in a circuit is the movement of free electrons in one direction. That is the direction of current flow in a circuit depends on the number of free electrons in the circuit.

236. If the value of C in a series RLC circuit is decreased, the resonant frequency–

(a) Decreases (b) Is not affected
(c) Increases (d) Is reduced to zero

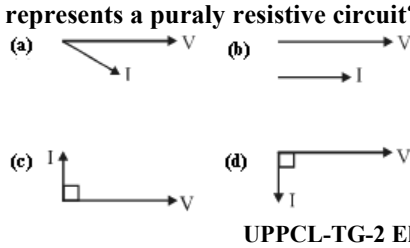
UPRVUNL-TG2 Instrumental-2015

Ans : (c) : If the value of C in a series RLC circuit is decreased, the resonant frequency increases

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

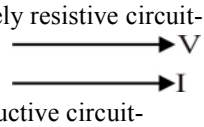
$$\uparrow f_r \propto \frac{1}{\sqrt{C}} \downarrow$$

237. Which of the following phasor diagrams represents a puraly resistive circuit?

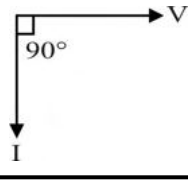


UPPCL-TG-2 Electrical-2014

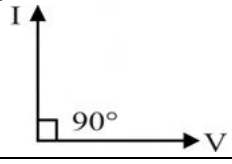
Ans : (b) For purely resistive circuit-



- For purely inductive circuit-



■ For purely capacitive circuit-



238. The power factor of an RC circuit is

(a) Lagging (b) Leading
(c) Unity (d) Zero

DMRC Maintainer Electrical-2014

Ans : (b) : The power factor of an RC circuit is leading because in a pure capacitive circuit the current leads the voltage by 90^0

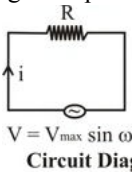
■ The power factor of an RL circuit is lags because in a pure inductive circuit the voltage leads the current by 90^0.

239. In a pure resistive circuit, current is_____ voltage and power factor is_____.

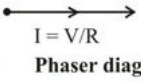
(a) Lagging behind, zero (b) Leading, zero
(c) In phase, zero (d) In phase, unity

UPPCL Technical Grade-II Electrical 11.11.2016

Ans : (d) : In a pure resistive circuit, current is same in phase voltage and power factor is unity.



Circuit Diagram



Phaser diagram

■ For pure resistive circuit the expression for power is the same as for D.C. circuit.

240. Frequency of a DC current is_____.

(a) Unity (b) Zero
(c) 50Hz (d) 220Hz

(UPPCL Technical Grade-II Electrical 11.11.2016)
RRB Trivendram (L.P.) 2006

Ans : (b) : Frequency of a D.C. circuit is zero and the A.C. supply frequency in a India 50 Hz. U.S.A. frequency of A.C. supply 60 Hz.

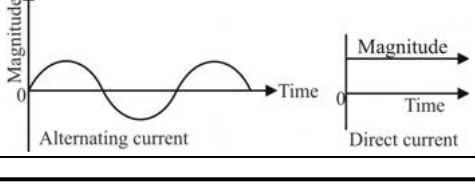
241. An electric current, which changes its direction after a certain fixed interval of time is called :

(a) Direct current
(b) Induced current
(c) Alternating current
(d) Magnetizing current

(R.R.B. Secunderabad (L.P.)-2004)

Ans : (c) : Alternating current can be defined as a current that change its magnitude and polarity at regular intervals of time.

■ Direct current (D.C.) is electrical current which flows consistently in one direction.



07.

❑ Concept of capacitor:

☛ **Definition**:

- A device with a dielectric medium installed between two metal conductor plate, which store the amount of electricity (charge) in multiples of the electric potential and distribution it when required is called as capacitor.
- The property of a capacitor due to which it opposes the change in voltage is called the capacitance of the capacitor

Type of Capacitor	Dielectric (Dielectric constant)	Range	Voltage Rat
Paper Capacitor	Impregnated paper (2-6)	0.0005 μF to 10 μF	100V to seve thousand vo
Polyester capacitor	Polyester (2.0)	0.0005μF to 10μF	upto 2000V
Ceramic capacitor	Ceramic (80-1200)	3 pf to 2μF	3V to 6000
Mica capacitor	Mica (3-8)	1 pf to 1 μF	500 V, 40kV high frequen
Electrolyte Capacitor	Aluminium Oxide (7)	1μF to several thousands μF	1V to 500V

Electric charge on capacitor:

- If a potential difference of V volts is set up across the two metal conductor plates of a capacitor, then the metal conductor plates get charged with a charge of Q coulomb.

  $Q \propto V$

  $Q = CV$ .....(i)

  $\therefore C = \frac{Q}{V} =$ Farad .....(ii)
- According to equation (i) capacitance of any capacitor (C), is the proportionality constant between Q and V.

Dependency of capacitance of a capacitor :

Capacitance of any capacitor C is depends on following factor-

- It is directly proportional to area means,

  $C \propto A$ .....(i)
- It is inversely proportional to distance i.e.

  $C \propto 1/d$.....(ii)
- It is directly proportional to absolute permittivity of medium i.e.

  $C \propto \varepsilon_a$ .....(iii)

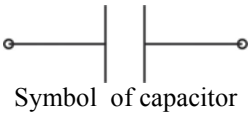
  Where, $\varepsilon_a = \varepsilon_0 \varepsilon_r$
- If any other charged object is placed near the capacitor, the value of C change.
- The value of capacitance changes with change in the medium surrounding the capacitor plates.

  From equation (i), (ii) and (iii)

  $$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$ Farad

Electrostatics

- The property of a capacitor to store charge is called its capacitance.
- Unit of the capacitor is Farad or Coulomb/volt.
  1 $\mu F = 10^{-6}$ F
  1 $nF = 10^{-9}$ F
  1 $pF = 10^{-12}$ F



Symbol of capacitor

ing	Tolerance	Leakage current	Polarity	Application
eral lts	± 10%	Low	No	AC, DC, High voltage and High Current
V	± 10%	Low	No	tuned circuit, Digital computer
V	± 10% to ± 20%	Low	No	Coupling capacitor, Bypass capacitor
at cy	± 0.5%	Low	No	Temperature varying
V	± 10%	High	Yes	Filter circuit, coupling capacitor

Dielectric constant or relative permittivity of material-

- The dielectric constant of any medium is the ratio of the capacitance C_m of the capacitor with that dielectric medium and the capacitance C_a with the air medium.
  It is expressed with the symbolic letter ε_r and is unitless quality.
  ε_r= Relative permittivity of medium.
  C_m = capacitance of capacitor with specific medium
  C_a = Capacitance of capacitor with air medium.

$$\varepsilon_r = \frac{C_m}{C_a}$$

$$= \frac{\text{Capacitance of a capacitor with a specific medium}}{\text{Capacitance of capacitor with air medium}}$$

- It is also known as specific inductive capacitance

$$\text{Dielectric Constant} = \frac{\text{Capacitance with material dielectric}}{\text{Capacitance of the same capaitor with air dielectric}}$$

Dielectric constant of some main dielectric material are following-

Sr. No.	Dielectric material	Permittivity
1.	Air	1.0006
2.	Bakelite	4.5 - 5.5
3.	Ebonite	2.8
4.	Fiber	2.5 - 5
5.	Glass	5.4 -9.9
6.	Mica	2.5 - 4.7

7.	Oil	2.2 - 4.7
8.	Paper	2.0 - 2.6
9.	Paraffin	2.1 - 2.5
10.	Rubber	2.0 - 3.6
11.	Wood	2.5 - 7.7
12.	Porcelain	5.7 - 6.8
13.	Quartz	4.5 - 4.7
14.	Vacuum	1.000
15.	Teflon	2.0
16.	Distilled water	80.0

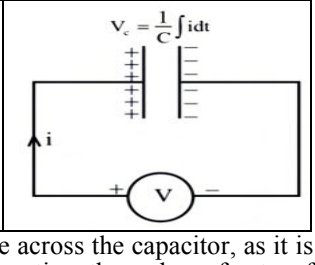
Circuit point of view-

$\because Q = CV$

as we known that

$i = \frac{dQ}{dt}$ i $\frac{dCV_c}{dt}$

i $C\frac{dV_c}{dt}$



Where, V_c is the voltage across the capacitor, as it is clear that the above equation the value of rate of change of voltage is zero then the value of current flowing in it will becomes zero, that is why the capacitor becomes open circuit for DC voltage i.e. capacitor blocks DC.

- $\frac{dV}{dt} \propto \frac{1}{C}$

From the above expression it is clear that in a capacitor 'C' is inversely proportional to $\frac{dv}{dt}$ then if capacitor C increased then $\frac{dv}{dt}$ is decreased.

- $V_C = \frac{1}{C}\int idt$

Current flowing through the capacitor is

$$i = \frac{CdV}{dt}, \quad dV = \frac{i}{C}dt, \quad \int_{v(0)}^{v(t)} dV = \int_0^t \frac{i}{C}.dt$$

$$[V]_{V(0^-)}^{V(t)} = \int_0^t \frac{i}{C}dt + 0, \quad V(t) - V(0^-) = \frac{1}{C}\int_0^t idt$$

$$V(t) = \frac{1}{C}\int_0^t idt + V(0^-)$$

From the above equation it is clear that the present value of the capacitor voltage is depends on previous value hence it can be have the memory properties.

Concept of short circuit and open circuit of capacitor with respect to time :

$$\because i = \frac{CdV}{dt}, \quad V(t) = \frac{1}{C}\int_0^t idt + V(0^-)$$

(1) With initial condition

or

With zero initial condition

at t = 0 $\Rightarrow$ as a voltage source
at t = ∞ $\Rightarrow$ open circuit

(2) **Without initial condition**

or

Relaxed (discharge) condition

at $t = 0 \Rightarrow$ short circuit
at $t = \infty \Rightarrow$ open circuit

Energy stored in capacitor-

$\because P = \dfrac{dW}{dt}$, $dW = Pdt$

$dW \quad V_c i_c dt \quad \because P \quad VI$

$$= \int \left(\frac{CdV_c}{dt} \right) V_c dt \quad = \int CV_c dV_c$$

$$\int dW = C \int V_c dV_c$$

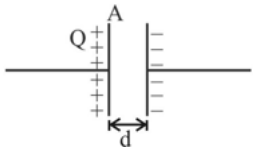
$$\boxed{W = \frac{1}{2} CV_c^2} \text{ Joule(watt.sec)}$$

Where V_c Voltage across capacitor

$\because$ Q=CV

$$\boxed{W = \frac{1}{2} CV^2 = \frac{1}{2} QV = \frac{1}{2} \frac{Q^2}{C}} \text{ joule(watt.sec)}$$

Stored energy per unit Volume



We know that

Energy stored in capacitor

$$W = \frac{1}{2} CV^2$$

Stored energy per unit volume

$$W = \frac{\frac{1}{2} CV^2}{A \times d}$$, where A= Area of Plate

d = Distance between plate

$$W = \frac{\frac{1}{2} \frac{\varepsilon_o \varepsilon_r A}{d} V^2}{A \times d} \quad \left(\because C = \frac{\varepsilon_o \varepsilon_r A}{d} \right)$$

$$= \frac{\varepsilon_o \varepsilon_r V^2}{2d^2} \quad = \frac{1}{2} \varepsilon_o \varepsilon_r \left(\frac{V}{d} \right)^2$$

$$W = \frac{1}{2} \varepsilon_o \varepsilon_r E^2 \qquad (\because V \quad E.d)$$

Where E=Electrical flux intensity

$$W = \frac{1}{2} (\varepsilon_o \varepsilon_r E) E$$

$$\boxed{W = \frac{1}{2} DE} \qquad (\because D = \varepsilon_0 \varepsilon_1 E)$$

Where D=Electrical flux density

Breakdown potential of a capacitor

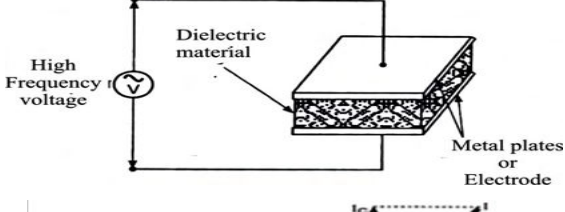
- The value of potential gradient of a capacitor a which its dielectric medium stop working is called breakdown potential.
- Its unit is V/mm
- This breaking strength of the dielectric of a capacitor depends on the thickness of the material.

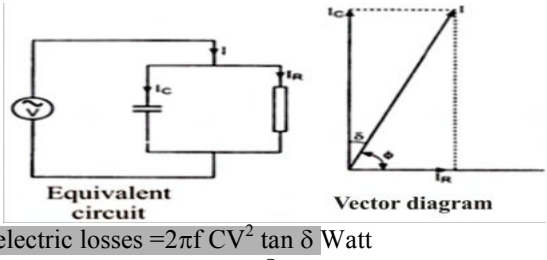
Dielectric Strength–

- The property of a material which resists dielectric breakdown is called dielectric strength. In other words the highest kilovolt per mm force that a medium can withstand without breaking down is called dielectric strength.
- It is expressed in volts per unit thickness.

Dielectric loss in dielectric material

- When a dielectric material is placed in an electrostatics field, a leakage current starts flowing in it due to external influences or impurities. This causes power losses in the form of heat in that material, which are called dielectric losses.
- The thermal power emitted from a dielectric material situated in an electric field is called dielectric power loss.





Dielectric losses $=2\pi f CV^2 \tan\delta$ Watt

Or

Dielectric losses $= 2\pi fCV^2 \cos\phi$ Watt

Where

f = supply frequency in cycle/Sec

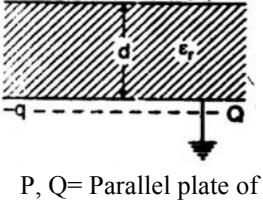
C = Capacitance of capacitor in Farad

V = Supply voltage in volt

$\cos\phi$= Power factor

Capacitance of parallel plate capacitor

(1) When the plates in uniform dielectric medium:



P, Q= Parallel plate of capacitor

A= Area of plate
q = Charge on plate
d = Distance between plates
ε_r= Relative permittivity of medium

Since electric flux density $D = \frac{q}{A}$

or

$$\boxed{D = \varepsilon_O \varepsilon_r E} \quad \therefore \; E = \frac{q}{\varepsilon_0 \varepsilon_r A} \text{ V/m}$$

Potential difference between both plate V=E×d

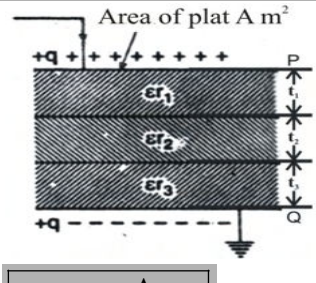
$$V = \frac{qd}{\varepsilon_O \varepsilon_r A}, \qquad \frac{q}{V} = \frac{\varepsilon_O \varepsilon_r A}{d}$$

$$C = \frac{\varepsilon_0 \varepsilon_r A}{d} \text{ Farad (in any medium)}$$

$$C = \frac{\varepsilon_0 A}{d} \text{ Farad (In air)}$$

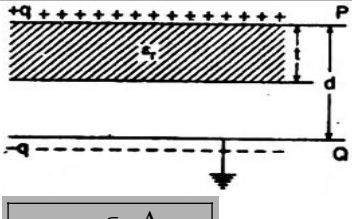
- It is clear that by putting dielectric between capacitors plate capacitance value can be increased.

(2) When a parallel capacitor has strips of different thickness and dielectric constant, then its capacitance:



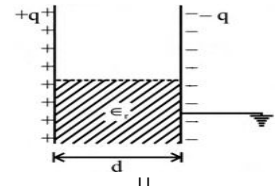
$$C = \frac{\varepsilon_O A}{\frac{t_1}{\varepsilon_{r_1}} + \frac{t_2}{\varepsilon_{r_2}} + \frac{t_3}{\varepsilon_{r_3}}} \text{ Farad}$$

(3) When some part of the parallel plates capacitor has air medium and some part has some other medium, then the capacitance of the capacitor -



$$C = \frac{\in_O A}{\left[d - \left(t - \frac{t}{\in_r}\right)\right]} \text{ Farad}$$

(4) When in the horizontal direction in the middle of the parallel plate capacitor some part in air and some another medium then the capacitance of the capacitor-



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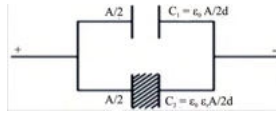
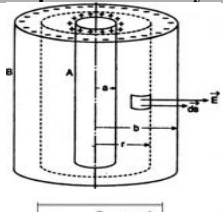


$C_{eq}=C_1+C_2,$ $\qquad C_{eq}=\dfrac{\varepsilon_0 A}{2d}+\dfrac{\varepsilon_0\varepsilon_r A}{2d}$

$$C=\frac{\varepsilon_0 A}{d}\left[\frac{1+\varepsilon_r}{2}\right]\text{Farad}$$ or $$C=C_{air}\left[\frac{1+\varepsilon_r}{2}\right]$$

- By placing a dielectric material in the horizontal direction between the plates of an air capacitor, the value of the capacitor becomes $\left(\dfrac{1+\varepsilon_r}{2}\right)$ times that of an air capacitor.

- **Capacitance of cylindrical capacitor**

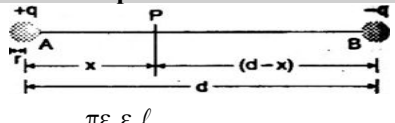


$$C=\frac{2\pi\varepsilon_o\ell}{\log_e\frac{b}{a}}\text{Farad}$$ or $$C=\frac{2\pi\varepsilon_0\ell}{2.303\log_{10}\frac{b}{a}}\text{Farad}$$

Where,

l=Length of cylindrical capacitor
a= radius of internal surface of the cylinder
b= radius of External surface of the cylinder
ε_0 = Permittivity of air

Capacitance of parallel conductor:



$$C=\frac{\pi\varepsilon_0\varepsilon_r\ell}{\log_e\frac{(d-r)}{r}}\text{Farad}$$

Or

$$C=\frac{\pi\varepsilon_0\varepsilon_r\ell}{2.303\log_{10}\frac{(d-r)}{r}}\text{Farad}$$

Since r is very small than d

$$\therefore\ C=\frac{\pi\varepsilon_o\varepsilon_r\ell}{2.303\log_{10}\frac{d}{r}}\text{Farad}$$

- Capacitance between parallel conductor for per unit length is

$$C = \frac{\pi\varepsilon_0\varepsilon_r}{2.303\log_{10}\frac{d}{r}} \text{ Farad / meter}$$

Where,

l= Length of conductor

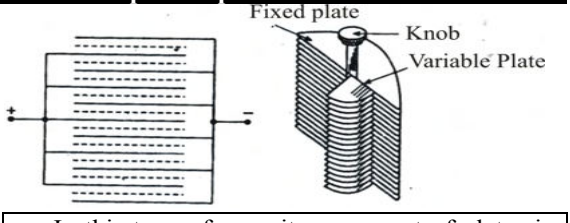
d= Distance between conductors

r = Radius of conductor

ε_o= Permittivity of air

ε_r= Relative permittivity of medium

Variable capacitor or multiplate capacitor or Gang capacitor or n-plate capacitor :



- In this type of capacitors, one set of plates is constant and other is variable and the capacitance of the capacitor is changed by rotating the knob.
- In a plate capacitor the negative plate is always one more than the positive plate for insulation protection.

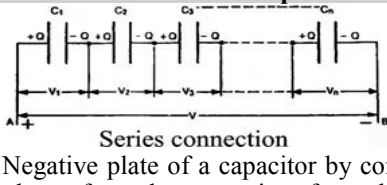
This types of capacitor used in radio.

$$C = \frac{(n-1)\varepsilon_o\varepsilon_r A}{d} \text{ Farad}$$

Combination of capacitors–

There are two types of combination of capacitor are possible.

(i) Series combination of capacitors-



Series connection

- Negative plate of a capacitor by connecting positive plate of another capacitor formed a series that is known as series combination.
- In series combination of capacitor, the charge on all the capacitor remain same, but the voltage across the capacitor varies according to its capacitance.

total voltage = sum of voltage drops across capacitor.

$$V = V_1 + V_2 + V_3 + \ldots\ldots + V_n$$

By putting the value

$$\frac{Q}{C} = \frac{Q}{C_1} + \frac{Q}{C_2} + \frac{Q}{C_3} + \ldots\ldots\ldots \frac{Q}{C_n}$$

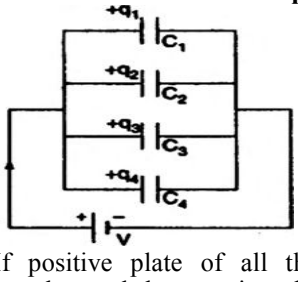
$$\frac{Q}{C} = Q\left(\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots\ldots \frac{1}{C_n}\right)$$

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots\ldots \frac{1}{C_n}$$

Conclusion–

- If several capacitor are connected in series the their equivalent capacitor will be smaller than the capacitance of the smallest capacitor.
- In series the over all capacitance of the capacitor decreases.
- If C capacitor of equal value connected in series then their equivalent capacitance will be $\frac{C}{n}$

(ii) Parallel combination of capacitors-



- If positive plate of all the capacitor connected together and the negative plates connect together is formed parallel connection of the capacitor. In parallel combination of capacitor the voltage across each capacitor are same but electric charge on each capacitor varies according to its capacitance.

  Total charge = Sum of charge of individual capacitor

  $Q = Q_1 + Q_2 + Q_3 + \ldots\ldots Q_n$

  $CV = C_1V + C_2V + C_3V + \ldots\ldots C_nV$

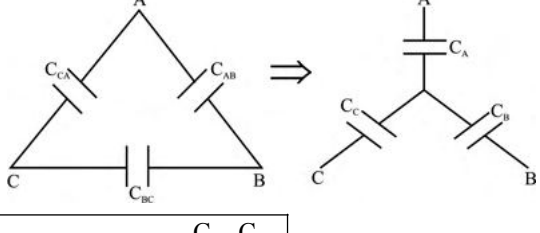
  $CV = V(C_1 + C_2 + C_3) + \ldots\ldots C_n)$

  $C = C_1 + C_2 + C_3 + \ldots\ldots C_n$

Conclusion–

- In parallel connection the value of equivalent. Capacitance of the capacitor is equal to the arithmetic sum of individual capacitors.
- In parallel combination of capacitor the value of the equivalent capacitor will be greater than the capacitance of the largest capacitors.
- If capacitor is equal capacitance C are connected in parallel then their equivalent capacitance will be equal to nC.

Conversion of delta connection to star connection of capacitor)-

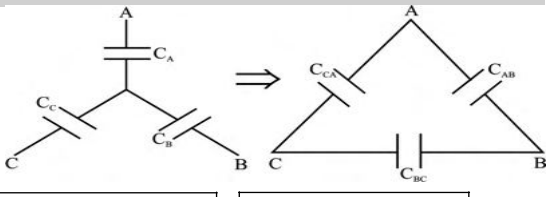


$$C_A = C_{AB} + C_{CA} + \frac{C_{AB}\,C_{CA}}{C_{BC}}$$

$$C_B = C_{AB} + C_{BC} + \frac{C_{AB}\,C_{BC}}{C_{CA}}$$

$$C_C = C_{BC} + C_{CA} + \frac{C_{BC}\,C_{CA}}{C_{AB}}$$

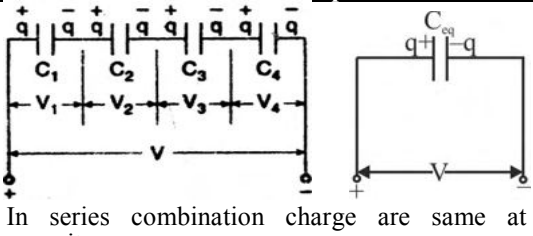
conversion of star connection to delta connection of capacitors:



$$C_{AB} = \frac{C_A C_B}{C_A + C_B + C_C} \qquad C_{BC} = \frac{C_B C_C}{C_A + C_B + C_C}$$

$$C_{CA} = \frac{C_C C_A}{C_A + C_B + C_C}$$

Distribution of voltage across capacitors in series:



- In series combination charge are same at all capacitor.

  $q=C_1V_1=C_2V_2=C_3V_3=C_4V_4=C_{eq}V$

  $V_1C_1=C_{eq}V$

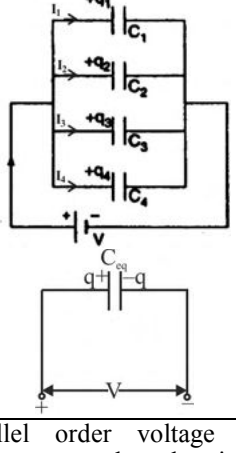
  $$V_1 \quad \frac{C_{eq}}{C_1}V$$

  Similarly $$V_2 \quad \frac{C_{eq}}{C_2}V \qquad V_3 \quad \frac{C_{eq}}{C_3}V$$

  $$V_4 \quad \frac{C_{eq}}{C_4}V$$

  Where, $$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \frac{1}{C_4}$$

Distribution of current across capacitor in parallel-



- In parallel order voltage across each capacitor are same but electric charge at its capacitor are different.

$$i_1 \quad \frac{C_1}{C_{eq}}I, \qquad i_2 \quad \frac{C_2}{C_{eq}}I, \qquad i_3 \quad \frac{C_3}{C_{eq}}I$$

Where, $C_{eq}=C_1+C_2+C_3+-----C_n$

Charging and Discharging of capacitor-

General equation for charging and discharging of capacitor

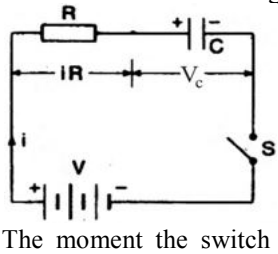
$V_c(t)= V_c(\infty)-[V_c(\infty)-V_c(o)]e^{-t/\tau}$ ------(1)

Time constant

RC Second

(A) Charging of capacitor-

- The circuit diagram of a capacitor in charging condition shown in the figure given below.



- The moment the switch 'S' is closed the potential difference on the capacitor will be equal to zero.
- Initially the charging takes place rapidly, but it will increases slowly between the two plates and finally become equal to V.
- As the emf on the capacitor increases the charge (q) on the capacitor will also increase and this charge will be taken battery.

From figure applied voltage is-

$V=V_R+V_C$, $V = IR+V_C$

$$RC\frac{dV_C}{dt} \quad V_C \quad \because I \quad I_C \quad C\frac{dV_C}{dt}$$

$$V_C = V - RC\frac{dV_C}{dt}$$

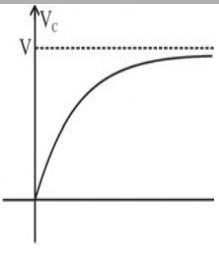
Instantaneous charging voltage–

From figure instantaneous charging voltage given by-

$V_C(0)=0$, $V_C(\infty)=V$

From equation (1)

$V_C(t) = V[1-e^{-t/\tau}]$



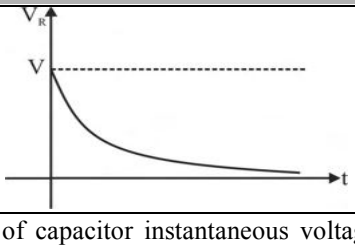
- During charging of capacitor instantaneous charging voltage increased exponentially.

Instantaneous voltage across resistance-

$V_R=V-V_C$

$= V-V[1-e^{-t/\tau}]$

$V_R \quad Ve^{\ t/}$

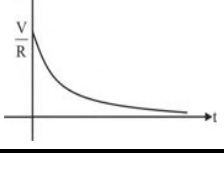


- During charging of capacitor instantaneous voltage across resistor decreased exponentially.

Instantaneous charging current:

$i_c \quad \frac{V_R}{R}$

$i_c \quad \frac{V}{R}e^{-t/}$



- During charging of capacitor instantaneous charging current decreased exponentially.

Rate of rise of voltage across capacitor-

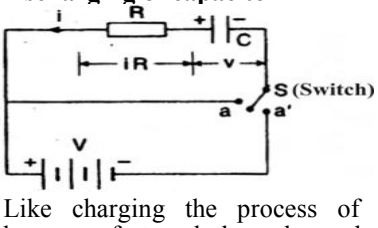
$$\frac{dV_c(t)}{dt} = \frac{V}{RC} e^{-t/\tau}$$

Initial rate of rise voltage across capacitor-

$$\left.\frac{dV_C}{dt}\right|_{at\ t=0} = \frac{V}{RC}$$

- Rate of change of voltage across a capacitor is inversely proportional to time constant.
- If any capacitor charge at the rate of initial value then it will get final value in a time constant.

(B) Discharging of capacitor-



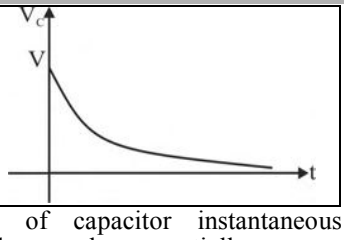
- Like charging the process of discharging first becomes fast and then slows down and becomes stable.
- The voltage polarity of the capacitor does not change when the capacitor is discharged.

During discharging-

$V_R + V_C = 0$

(i) Instantaneous discharging voltage-

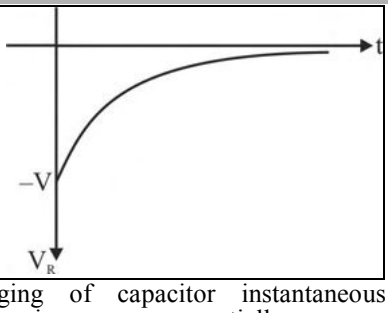
$V_C(\infty)=0$
$V_C(0)=V$
$\tau=RC$
From equation (i)
$V_C(t) = Ve^{-t/\tau}$



- During discharging of capacitor instantaneous discharging voltage decreased exponentially.

(ii) Instantaneous voltage across resistance-

$V_R = -V_C$
$V_R = -Ve^{-t/\tau}$

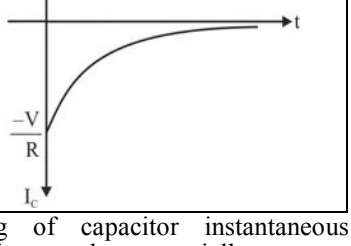


- During discharging of capacitor instantaneous discharging voltage increases exponentially.

(iii) Instantaneous discharging current):

$i_c \quad \frac{V_R}{R}$

$i_C \quad -\frac{V}{R} e^{-t/}$



- During discharging of capacitor instantaneous discharging current increased exponentially.

Time constant:

- The time constant a capacitive circuit is the time taken for the charging current of the capacitor to remain 0.368 or 36.8% of its initial value.
- The time constant of a capacitive circuit is the time taken for the discharging current of the capacitor to becomes 0.6321 or 63.21% of its.
- If there are many resistance and capacitance in the circuit then the time constant of the circuit is-

$$\boxed{\tau = C_{equ} R_{th}}$$

- The pure capacitor gets charged instantly from the ideal voltage source.

Application of capacitors:

- To automates single phase alternating current motors such as fans induction motor etc.
- For correction power factor such as supply line of industries .
- For starting of single phase induction motor.
- For balance of AC bridge.
- For matching of radio receiver station such as gang capacitor.
- For storing of electrical energy in electrical field.
- For measurement instrument such as electrostatic volt meter.
- For operating of ON & OFF switching and relay circuit.
- In electronic circuit for blocking of DC component such as filter.

EXAM POINTS

- Dielectric constant is mathematically equal to- **Relative permittivity**
- Impedance offered to the direct current by a capacitor filter used along with rectifiers having a capacitance of C farad is - **Infinity**
- Absolute permittivity of the material is the– **Ratio of electric field density to electric field intensity producing that field density**
- _____ is a region around a stationary electric charge– **Electric field**
- To optimize the economic limit, power factor is improved by installing - **Static capacitors**
- A cluster of charge with an electric dipole moment is often called– **Electric dipoles**
- ..... capacitor has the lowest value of leakage resistance is - **Electrolytic capacitor**
- The formula for the capacitance of capacitor is – $\boxed{C = \frac{\varepsilon_o \varepsilon_r A}{d}}$ **Farad**
- Absorbed moisture contents affect the dielectric strength– **Indirectly**
- If the relative permittivity of the medium increases, the electric intensity at a point due to a given charge– **Decreases**
- While charging accumulators, one should– **Keep it in a well-ventilated space**
- The capacitance of a capacitor is not influenced by - **Conductive plate thickness**
- The unit of electric field intensity is - **Newton/Coulomb, Volt/meter**
- The unit of electrostatic charge is - **Ampere-second**

- ……. is a proportionality factor relating the charge between two metal surfaces- **Capacitance**
- Time constant of a circuit is the time in seconds taken after the application of voltage to each– **63% of maximum value**
- Coulomb's law for the force between electric charges closely resembles with..... **'Newton's law of gravitation'**
- When moisture gets into the insulating material then- **It increases the dielectric loss**
- If three 5 μF capacitors are connected in parallel, then the net capacitance is– **15 μF**
- Dielectric loss is proportional to– **Frequency**
- Mica or ceramic condenser is a type of– **Fixed condenser**
- With the increase in applied frequency, the dielectric loss in a material will– **Increase**
- The electric field intensity due to an infinite plane sheet of charge is– **Independent of the location of the field point P**
- At a dielectric-dielectric boundary the pressure is– **In a direction to draw the dielectric of higher permittivity into the dielectric of lower permittivity**
- Capacitors with solid dielectric materials ------- because– **They are smaller in size as compared with air capacitors**
- The unit of dielectic strength is given by– **V/m**
- The essential condition for the Paschen's law to be valid is that– **Temperature must be constant**
- Sparking occurs when a load is switched off because the circuit has– **High inductance**
- Which bridges are used to measure dielectric loss of a capacitor– **Schering bridge**
- The current through a capacitor is given by– **i = C dv/dt**
- In a sample and hold circuit, the voltage across the capacitor changes by.....during hold time – **50%**
- An electric element capacitor is specified by– **Voltage and capacitance**
- The reactance of capacitors increases as : **Decreases frequency**
- The expression for the capacitance is– $C = \frac{Q}{V}$
- Dielectric constant of air is– **Equal to 1**
- The insulating materials used for a capacitor are– **Mica, mineral oil and ceramic**
- The term used to describe the ability device to store energy in the form of an electrical charge is– **Capacitance**
- _____consists of two metal plates separated by a dielectric can store charge– **Capacitor**
- Generally an electrolytic capacitor is made to provide– **Large value of capacitance**
- Internal heating of capacitor is usually attributed to– **Leakage resistance**
- For making capacitors, it is better to select a dielectric material having– **High permittivity**
- A capacitor has– **two Conductors separated by a dielectric**
- A capacitor opposes– **Change in voltage**
- An electrolytic capacitor can be used for– **only DC**

- passive component is a – **Resistors, Inductors, Capacitors**
- The current in capacitive circuits ——— the voltage– **Leading**
- A trimmer is basically, a– **Capacitor**
- ..... is a bilateral element– , **Resistance, Inductance, Capacitance**
- Capacitors are said to– **Block DC and pass AC**
- When a current source is connect to a capacitor– **The displacement current flows through the capacitor**
- The best place to install a capacitor is– **Across the terminals of the inductive load**
- The capacitance of a capacitor is ..... relative permittivity– **Directly proportional to**
- A capacitor that has been connected across a battery for comparatively long time becomes– **Charged**
- A dielectric material must be– **Insulator**
- A gang condenser is a– **Variable capacitor**
- When a dielectric slab is introduced in a parallel plate capacitor, the potential difference between plates will– **Decrease**
- Capacitance increases with– **Increase in plate area and decrease in distance between the plates**
- The ratio of electric flux density to electric field intensity is called.....of the medium– **Permittivity**
- The relative permittivity of free space is given by– **1**
- Electric field intensity is a.....quantity– **Vector**
- The capacitor bank used in power factor corrections is expressed in terms of– **kVAr**
- Dielectric constant for mica is nearly– **3 to 8**
- The value of dielectric constant for vacuum is taken as– **1**
- The units of volume charge density are– **Coulomb/meter^3**
- Dielectric strength of mica is– **50 to 200 kV/mm**
- The dielectric constant (relative permittivity) of glass is given by– **5 to 10**
- "The surface integral of normal component of the electric intensity E over a closed surface is equal to $\frac{1}{\epsilon_0}$ times the total charge inside it". The above statement is known as– **Gauss's theorem**
- The inverse of capacitance is called– **Elastance**
- ..... field is associated with the capacitor– **Electric**
- ..... at a point is equal to the negative potential gradient at that point– **Electric intensity**
- Dielectric strength ..... with increasing thickness– **Decreases**
- The relation between the breakdown voltage V and the thickness (t) of the dielectric is given $V = At^{2/3}$, where A is a constant depending on the nature of the medium and also on the thickness t The above statement is known as– **Bohr's law**
- The appropriate dielectric strength in (volts/mm) of gutta-percha is– **10,000–25,000**
- A capacitance of 1 μF equals– **10^{-6} F**
- The electrical equipment occasionally connected across relay contacts for minimizing arcing is a– **Capacitor**
- A variable capacitor is one whose capacitance– **Can be changed**

- Dielectric strength of air is nearly– **3 kV/mm**
- Dielectric strength of a medium is usually expressed in– **kV/mm**
- ..... medium will have highest value of relative permittivity– **Water**
- Calculate dipole moment for the arrangement shown in the figure- **2qr**
- Electric field inside a hollow metallic charged sphere is– **Zero**
- A conducting body has surface charge density of σ coulombs/m^2, the field intensity at its surface will be– $\frac{\sigma}{\varepsilon_0 \varepsilon_r}$
- The dissipation factor of a good dielectric is of the order of– **0.0002**
- The expression for Gauss' Law– $\phi_E = \frac{q}{\varepsilon_0}$
- ..... formula is correct for electric field strength– **$E = D/\varepsilon$**
- An electric field of 100 kV/m is equal to– **100 V/mm**
- In a capacitor the electric charge is stored in– **Dielectric**
- The power dissipated in a pure capacitor is– **Zero**
- The electric field at a point situated at a distance d from straight charged conductor is– **Inversely proportional to d**
- The direction of electric field due to positive charge is– **Away from the charge**
- A field line and an equipotential surface are– **Always at 90°**
- The ability of charged bodies to exert force on one another is attributed to the existence of– **Electric field**
- A small capacitor is connected across a battery for a one minute, If now an ammeter is inserted to measure the current drawn by the capacitor, it would read– **Zero**
- The electric field lines and equipotential lines– **Cut each other orthogonally**
- Space surrounding a charge, within which the influence of its charge extends is known as– **Electric field**
- The sure test of electrification is– **Repulsion**
- The charge distribution on a conical shaped conductor is– **Uniform**
- An electric field can deflect– **α-particles**
- An electric line of force always starts on– **A positive charge and ends on a negative charge**
- Static charges generated in liquid reside– **On the top surface of liquid**
- The relative permittivity of most materials lies between– **1 and 10**
- The charge of an isolated conductor resides– **At the conductor surface**
- The minimum value of the charge on any object cannot be less than– **1.6×10^{-19} coulomb**
- In a cable capacitor, voltage gradient is maximum at the surface of the– **Conductor**
- Permittivity is expressed in– **Farad/metre**

- ..... will happen to an insulating medium if voltage more than the breakdown voltage is applied on– **It will get punctured or cracked**
- The relative permittivity of an insulator cannot be– **Infinity**
- A hollow metal sphere of radius 5cm is charge such that the potential surface is 10 volts. The potential at the centre of sphere is– **10V**
- Permittivity of vacuum is – **8.854×10^{-12}F/m**
- The electric field strength a distance point, due to a point charge, +q , located at the origin, is 100μVm. If the point is now enclosed by a perfectly conducting sheet sphere at the point P. outside the sphere, becomes:– **Zero**
- The law used to determine the force between two current carrying conductor is– **Bio-Savart's law**
- ..... does the region around the stationary electric charge has– **Electric field**
- ..... is a scalar quantity – **Electric potential**
- A closed surface encloses the point charge Q and has a medium with permittivity of free space ε_0 Then the Gauss's law should not be represented by– $\nabla \times E = Q/\varepsilon_0$
- The electric field intensity inside a charged spherical conductor is– **Zero**
- The potential of a point charge at a distance r is given by– $\frac{Q_1}{4\pi\varepsilon_0 r}$
- Point charges of –10 nC and 10 nC are located in free space at (–1, 0, 0) m and (1, 0, 0) m respectively. The energy stored in the field is– **–450 nJ**
- A unit tube of flux is known as.....tube– **Faraday**
- The number of Faraday tubes of flux passing through a surface in an electric field is called– **Electric flux**
- A uniform plane wave has a wavelength of 2 cm in free space and 1 cm in a perfect dielectric. The relative permittivity of dielectric is– **4**
- The ability of charged bodies to exert force on one another is attributed to the existence of– **Electric field**
- Line charge is given by – **Gauss law**
- Value of constant k in Coulomb law has value of– 9×10^9
- Electric field is defined as – **Force per unit charge**
- Electric field is a – **Vector Quantity**
- The value of E within the field due to a point charge can be found with the help of– **Coulomb's laws**
- ..... at a point may be defined as equal to the lines of force passing normally through a unit cross-section at that point– **Electric intensity**
- Electric flux density (D) is related to electric field intensity (E) by the relation– $D = \epsilon_0\epsilon_r E$
- A negatively charged body has–**Excess of electrons**
- A rod insulating material is given a positive charge by rubbing it with a piece of fabric and the Fabric is then tested for electric charge. You would expect the fabric to have– **A negative charge equal to that on the rod**
- Two charges of equal magnitude are separated by some distance. If the charges are increased by10% to get the same force between them, their separation must be– **Increased by 10%**

- A soap bubble is given a negative charge then its radius– **Increases**
- Equal charges are given to two spheres of different radius. The potential will– **Be more on the smaller sphere**
- Unit of absolute permittivity is – **Farad/meter**
- A electric field line and equipotential surface are – **Always at 90^0**
- The unit of electric dipole moment is – **Coulomb-meter**
- The electric field lines are – **Either straight line or smooth curved lines**
- The total electric flux through any closed surface surrounding charges is equal to the amount of charges enclosed. The above statement is based on– **Gauss's law**
- The force of attraction between two electric charge of opposite polarity having 1 Coulomb each when placed at a distance of 1m is– **9×10^9 Newton**
- According to Gauss's law, if E is.....the charge density in the ideal conductors is zero– **Zero**
- If a body has identical properties all over, it is known as– **Homogeneous**
- A point charge in space is attracted towards a dielectric material because of the– **Maximization of electrostatic flux.**
- The potential gradient across the material of low permittivity is ..... than across the material of high permittivity– **Greater**
- When a dielectric is placed in an electric field, it becomes– **Polarized**
- XEROX machine is working on–**Electrostatic effect**
- An uncharged conductor is placed near a charged conductor, then– **The uncharged conductor gets charged by induction and then attracted towards the charging body**
- In parallel combination of capacitances, the equivalent capacitance is– **Greater than the largest capacitance of the combination**
- If a number of capacitors are connected in series, then the total capacitance of the combination will be– **Smaller than the capacitance of the smallest capacitor**
- The unit of capacitance is– **Coulomb/Volt**
- When a dielectric is placed in an electric field, the field strength– **Decreases**
- ..... happens to current flow in a capacitive circuit when the DC voltage across the capacitor is approximately equal to the source voltage– **Little current flows**
- A capacitor can represented by a capacitance and resistance in parallel. For a good capacitor, this parallel resistance is– **Very high**
- The electrical capacitance is analogous of– **Spring**
- A circuit component that opposes the change in circuit voltage is– **Capacitance**
- Capacitance of a capacitor– **Increases with increases in overlapping Area of plates, Increases with increases in relative permittivity of the dielectric, Increases with decreases in distance between the plates**
- Farad is the unit of– **Capacitance**

PREVIOUS YEA

1. The unit of absolute permittivity of a medium is:

(a) Joule/Coulomb (b) Newton/Meter
(c) Farad/Meter (d) Farad/Coulomb

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Gujarat Telecom Circle- 2012

Ans. (c) : $\because F = \frac{1}{4\pi\varepsilon}\frac{Q\times Q}{r^2}$

So, $F = \frac{1}{4\pi\varepsilon}\frac{Q^2}{r^2}$

$\varepsilon = \frac{Q^2}{4\pi r^2 F}$

$\because C = \frac{Q}{V}$

$V = \frac{W}{Q}$

So, $C = \frac{Q^2}{W}$

$Q^2 = CW$

$\varepsilon = \frac{CW}{4\pi r^2 F}$ [W = work]

$= \frac{F\times Nm}{m^2\times N}$

$\varepsilon = \frac{F}{m}$ Farad / meter

2. The amount of charge which will flow through a metallic wire in 90 minutes when a constant current of 0.4 ampere is flowing through it is ---------- .

(a) 5400 C (b) 2160 C
(c) 4320 C (d) 7560 C

NPCIL KAIGA SA/ST CAT-1, 28.08.2022

Ans. (b) : Given that-
Current (i) = 0.4 Amp
Time (t) = 90 minute
= 90×60 = 5400 second
Q = it
0.4×5400 = 2160 C

3. Two capacitor of value 8μF are connected in series and this combination is in parallel with a capacitor of 10μF. What is the equivalent capacitance of the system?

(a) 20 μF (b) 8 μF
(c) 14μF (d) 16 μF

SSC IMD (SA) 16.12.2022, Shift-I

Ans. (c) :
When to 8μF capacitor connected in series
When capacitor connected in parallel with 8□F of 2 capacitor in series combination-

AR QUESTIONS

4. A 0.01 μF capacitor is equal to how many picofarad?

(a)1,000 pF (b) 100 pF
(c) 10, 000 pF (d) 100, 000 pF

SSC IMD (SA) 15.12.2022, Shift-III

Ans. (c) : Given that -

$C = 0.01\mu F$, $1pF = 10^{-12}$ F, $1\ \mu F = 10^{-6}F$

Value of capacitor in picofarad-

$C_{pF} = 0.01\times10^{-6}\times10^{12}$

$= 0.01\times10^{6}$

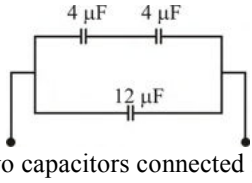
= 10000 pF

5. Two capacitor each value 4 μF are connected in series and this combination is in parallel with a capacitor of 12 μF. What is the equivalent capacitance of the system?

(a) 16μF (b) 14 μF
(c) 20μF (d) 8μF

SSC IMD (SA) 15.12.2022, Shift-III

Ans. (b) :



4μF value of two capacitors connected in series

$C_1 = \frac{4\times4}{4+4} = 2\mu F$

When 12μF connected in parallel

$C = C_1 + 12$

$= 2 + 12 = 14\mu F$

6. If 60J of energy is available for every 15C of charge then, what is the voltage?

(a) 8 V (b) 4 V
(c) 12 V (d) 10 V

SSC IMD (SA)-15.12.2022, 5:00PM

Ans. (b) : Given that,

Q = 15C, W = 60J

We know that,

$$V = \frac{W}{Q} = \frac{60}{15} = 4V$$

7. 1000V power supply would use which capacitor for filter_____

(a) Mica (b) Electrolyte
(c) Paper (d) Air

SSC IMD (SA) 15.12.2022, Shift-III

Ans. (c) : For 1000 V power supply filter used to paper capacitor. A paper capacitor is made with paper as the dielectric medium and is capable of storing the electrical charge in it. The range of paper capacitor is 100V-1000V.

8. 10 pF capacitor is connected to a 50V battery. How much Electrostatic energy is stored in the capacitor?

(a) $1.5*10^{-08}$ J (b) $1.25*10^{-08}$ J
(c) $1.75*10^{-08}$ J (d) $1.37*10^{-7}$ J

ISRO URSC TA (EC) 03.11.2022

Ans. (b) : Given that,

C= 10 pF = 10×10^{-12}F, V = 50V

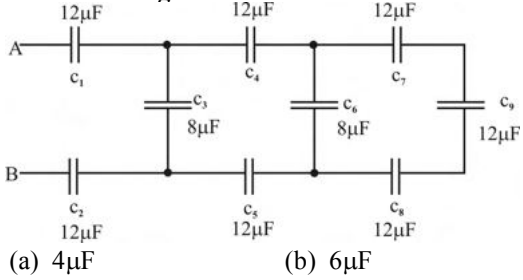
Energy store in capacitor (E) = $\frac{1}{2}CV^2$

$$=\frac{1}{2}\times10\times10^{-12}\times(50)^2$$

$$=\frac{1}{2}\times10\times2500\times10^{-12}$$

$$= 1.25\times10^{-8}\text{ J}$$

9. The total equivalent capacitance of the series parallel combination of capacitors across A and B Shown in figure is

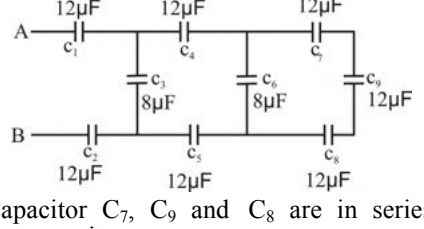


(a) 4μF (b) 6μF

(c) 16μF (d) 27μF

ISRO VSSC TA (EC) 14.07.2021

Ans. (a) : Given, circuit is -



Since Capacitor C_7, C_9 and C_8 are in series, Their equivalent capacitance.

$$\frac{1}{C_T}=\frac{1}{C_7}+\frac{1}{C_8}+\frac{1}{C_9}$$

$$\frac{1}{C_T}=\frac{1}{12}+\frac{1}{12}+\frac{1}{12}$$

$C_T = 4\ \mu F$

Since capacitor C_T and C_6 are in Parallel, Their equivalent capacitance is -

$C'_T = C_T + C_6$

$= 4\ \mu F + 8\mu F$

$C'_T = 12\mu F$

Now C_4 , C_5 and C'_T are in series, Then their equivalent capacitance -

$$C'_2 = \frac{1}{C_4}+\frac{1}{C_5}+\frac{1}{C'_T}$$

$$= \frac{1}{12}+\frac{1}{12}+\frac{1}{12}$$

$C'_2 = 4\mu F$

Since C'_2 and C_3 are in parallel, Then the equivalent capacitance -

$C''_2 = C'_2 + C_3$

$= 4\mu F + 8\mu F$

$C''_2 = 12\mu F$

Now C_1, C_2 and C_2'' are in series, Then their equivalent capacitance -

$$\frac{1}{C_{AB}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_2''} = \frac{1}{12} + \frac{1}{12} + \frac{1}{12}$$

$$\boxed{C_{AB} = 4\mu F}$$

10. _____ essentially consists of two conducting surfaces separated by a layer of an insulating medium called dielectric.

(a) A capacitor (b) A semiconductor
(c) An inductor (d) A resistor

DFCCIL Executive (EE) -30.09.2021

Ans. (a) : Capacitor :- A capacitor essentially consist of two conducting surfaces separated by a layer of an insulating medium called dielectric.

• Capacitance of parallel plate capacitor.

$$\boxed{C = \frac{A.\varepsilon}{d}} \text{ Farad}$$

Where $\varepsilon = \varepsilon_0 \varepsilon_r$

ε = Permittivity of dielectric (absolute, not relative)
A = Area of plate in meter square
d = Distance between plates in meters

11. If a capacitance is charged by a square wave current source, then the voltage across the capacitor will be:

(a) Square wave (b) Step function
(c) Triangular wave (d) Zero

NSC-24.02.2021

Ans. (c) : If capacitor is charged by a square wave current source, then the voltage across the capacitor will be triangular wave.

$$\boxed{V = \frac{1}{C}\int i dt}$$

$\because$ The integral of a square wave is a triangular wave.

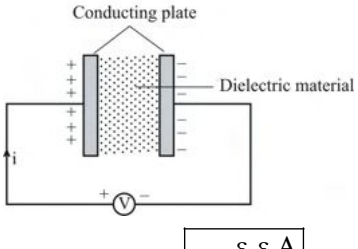
The voltage across the capacitor will be like a triangular wave.

12. The capacitance of a capacitor is not affected by.....

(a) Plate area (b) Plate separation
(c) Nature of dielectric (d) Plate thickness

NSC-24.02.2021

Ans. (d) : The capacitance of a capacitor is not affected by Plate thickness.



Capacitance of a capacitor, $\boxed{C = \frac{\varepsilon_0 \varepsilon_r A}{d}}$ farad

The capacitance (C) of a capacitor depends on the following factors.

■ It is proportional to the cross-sectional area $\boxed{C \propto A}$

■ It is inversely proportional to distance $\boxed{C \propto \frac{1}{d}}$

■ It is directly proportional to the absolute permitivity of the medium $\boxed{C \propto \varepsilon}$

13. The capacitive reactance of a 0.01 micro farad capacitor to a frequency of 100 kHz will be:

(a) 0.006 Ohm (b) 15Ohm
(c) 115 Ohm (d) 159 Ohm

NSC-24.02.2021

Ans. (d) : Given that

$f = 100 \text{ kHz} = 100\times10^3 \text{ Hz}$

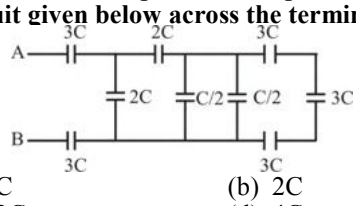
$C = 0.01 \ \mu F = 0.01 \times10^{-6} F$

$$X_C = \frac{1}{2\pi fC}$$

$$= \frac{1}{2\times3.14\times100\times10^3\times0.01\times10^{-6}}$$

$$\boxed{X_C = 159.23\Omega}$$

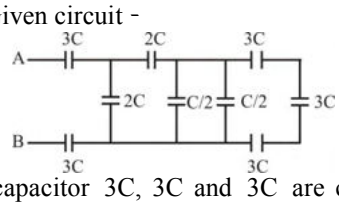
14. What is the equivalent capacitance of the circuit given below across the terminals A & B?



(a) C (b) 2C
(c) 3C (d) 4C

ISRO VSSC TA (EC) 09.06.2019

Ans. (a) : Given circuit -

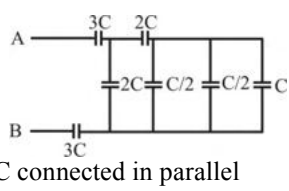


Last three capacitor 3C, 3C and 3C are connected in series

So, equivalent capacitance-

$$\frac{1}{C_{eq}} = \frac{1}{3C} + \frac{1}{3C} + \frac{1}{3C}$$

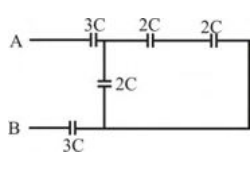
$C_{eq} = C$



C/2, C/2 and C connected in parallel

$C_{eq} = C/2 + C/2 + C$

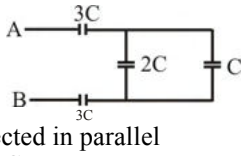
$C_{eq} = 2C$



2C and 2C connected in series

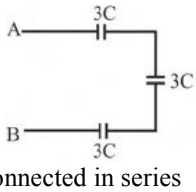
$$\frac{1}{C_{eq}} = \frac{1}{2C} + \frac{1}{2C} = \frac{2}{2C} = \frac{1}{C}$$

$C_{eq} = C$



2C and C connected in parallel

$C_{eq} = 2C + C = 3C$



So, all capacitor connected in series

Hence, $\frac{I}{C_{eq}} = \frac{1}{3C} + \frac{1}{3C} + \frac{1}{3C} = \frac{1+1+1}{3C} = \frac{3}{3C}$

$C_{eq} = C$

15. Capacitive reactance is inversely proportional to–

(a) Voltage (b) Amplitude
(c) Frequency (d) Current

RRB JE- 01.09.2019

Ans. (c) : Capacitive reactance is inversely proportional to frequency. The capacitive reactance is denoted by X_C.

$$X_C = \frac{1}{2\pi fC}$$

$$\boxed{X_C \propto \frac{1}{f}}$$

As the value of frequency increases, the value of capacitive reactance also decrease.

16. Which component opposes voltage change?

(a) Resistor (b) Inductor
(c) Capacitor (d) Transistor

ISRO : PCM TA (EC) 21.04.2018

Ans. (c) Capacitor component opposes voltage change.

$\because$ $\boxed{I_C = C.\frac{dv}{dt}}$ $\therefore$ $\boxed{V_C = \frac{1}{C}\int i\,dt}$

$\because$ $Q \propto V$

$Q = C.V.$

$\boxed{C = \frac{Q}{V}}$ farad

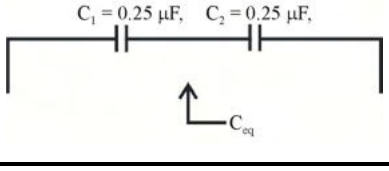
- The inductor opposes the sudden change in current.
- Resistance opposes the flow of current.

17. If two 0.25 micro Farad capacitors are connected in series, what will be the total effective capacitance?

(a) 0.125 micro farad (b) 0.0624 micro farad
(c) 2.5 micro farad (d) 0.5 micro farad

ISRO : PCM TA (EC) 21.04.2018

Ans. (a) According to question –



We know that−

For series combination of capacitor -

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$\therefore \quad C_{eq} = \frac{C_1.C_2}{C_1 + C_2} = \frac{0.25 \times 0.25}{0.25 + 0.25}$$

$$C_{eq} = \frac{0.0625}{0.50}$$

$$\boxed{C_{eq} = 0.125\mu F}$$

18. A capacitor is charged by a constant current of 1 mA and result in a voltage increase of 10 V in a 5 sec interval. The value of capacitance is

(a) 0.50 mF (b) 1.33 mF

(c) 2 μF (d) 2 mF

ISRO: VSSC TA (EC) 25.02.2018

Ans : (a) Given that -

$I = 1mA$

$dV_c = 10V$

$dt = 5sec$

$$\because \quad I = C.\frac{dV_c}{dt}$$

$$1 \times 10^{-3} = C\left(\frac{10}{5}\right)$$

$$\boxed{C = 0.50 \text{ mF}}$$

19. A capacitor that can store 100 μC of charge with 10V across its plates has a capacitance value of

(a) 0.01 μF (b) 0.1 μF

(c) 10.0 μF (d) 1.0 μF

ISRO:SCB TA (EC) 20.08.2017

Ans : (c) ∵ Given that −

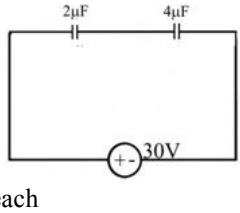
$\because \quad Q = 100\mu C, \quad V = 10V$

$\because \quad Q = CV$

$$\therefore \quad C = \frac{Q}{V} = \frac{100}{10}$$

$$\boxed{C = 10\mu F}$$

20. Two capacitors of 2 μF and 4 μF capacitance are connected in series across a 30 V dc battery. After the capacitors have been charged, the voltage across them will be?



(a) 15V each

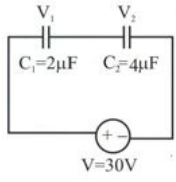
(b) 10V and 20V respectively V

(c) 20V and 10V respectively

(d) 30V each

ISRO: PCM TA (EC) 10.12.2016

Ans. (c) :



$$V_1 = \left(\frac{1/C_1}{1/C_1 + 1/C_2}\right) \times V = \left(\frac{1/2}{1/2 + 1/4}\right) \times 30 = \frac{2}{3} \times 30$$

$$\boxed{V_1 = 20V}$$

$$V_2 = \left(\frac{1/C_2}{1/C_1 + 1/C_2}\right) \times V = \left(\frac{1/4}{1/2 + 1/4}\right) \times 30 = \frac{1}{3} \times 30$$

$$\boxed{V_2 = 10V}$$

Note: In series combination value of charge is equal.

21. The time rate of change of a voltage applied across a 1μF capacitor is 2V/s. This means that the current flowing through the capacitor is

(a) 2×10^{-6}A (b) 2A

(c) 0.5×10^{-6}A (d) 0.5A

BSNL (JTO) 2001

Ans : (a) Capacitor (C) = 1μF = 1×10^{-6}F, $\left(\frac{dv}{dt}\right) = 2$ volt/sec

We know that -

$$i = \frac{dq}{dt} = C\frac{dv}{dt} = 1 \times 10^{-6} \times 2 = 2 \times 10^{-6} \text{ amp}$$

22. Potential difference across a 0.04 F capacitance is 4V. Charge stored in it will be :

(a) 0.1 C (b) 2.1 C

(c) 0.16 C (d) 0.016 C

UPPCL JE Electrical, 11.11.2016

Ans : (c) Given that -

Capacitance (C) = 0.04F

Potential difference (V) = 4V

Charge (q) = Potential difference × Capacitance

q = CV

= 0.04×4 = 0.16 Coulomb

23. The energy stored in a 10μF capacitor when charged to 500V is

(a) 1.25J (b) 5mJ

(c) 50 J (d) 2.5 mJ

UPPCL A.E. Electrical, 12.11.2016

Ans : (a) Given that -

C = 10μF = 10×10^{-6}F

V = 500 volt

Stored energy (W) = $\frac{1}{2}CV^2 = \frac{1}{2} \times 10 \times 10^{-6} \times 500 \times 500$

$= \frac{1}{2} \times 25 \times 10^{-1} = 1.25J$

24. The charge on a 20 pF capacitor when the 20 kV voltage applied to it, is

(a) 400μC (b) 0.4C

(c) 0.4μC (d) 0.04μC

UPPCL A.E. Electrical, 12.11.2016

Ans : (c) Given that -

$C = 20\ pF = 20\times10^{-12}F$

$V = 20\ kV = 20\times10^{3}V$

Formula -

$q = CV$

$q = 20\times10^{-12}\times20\times10^{3}$

$q = 4\times10^{-7}$

$q = 0.4\times10^{-6}$

$q = 0.4\mu C$

25. What is the term used to describe the ability of a device to store energy in the form of an electrical charge?

(a) inductance (b) conductance

(c) reactance (d) capacitance

(RRB SSE (shift-III), 02.09.2015)

Ans : (d) Capacitor – Electrical component that consist of two conductors separated by an insulator or dielectric material is known as capacitors. Capacitor stores energy in the form of an electrical charge.

$$E = \frac{1}{2}CV^2$$

A capacitor is used for power factor improvement.

26. A capacitor is basically constructed of–

(a) Conductor and Semiconductor

(b) Conductor and Dielectric

(c) Two conductors separated by a dielectric

(d) Two dielectric separated by a conductor

RRB JE (Shift-III), 16.09.2015

Ans : (c) A capacitor consist of two conductor separated by an insulator or dielectric material.

$$C = \frac{\varepsilon_0\varepsilon_r A}{d}\ F$$

27. If two equal-value capacitors are connected in parallel, what is their capacitance?

(a) The same value of either capacitor

(b) The value of one capacitor times the value of the other

(c) Half the value of either capacitor

(d) Twice the value of either capacitor

RRB SSE (Shift-III), 03.09.2015

Ans : (d) If two equal-value capacitors are connected in parallel then total capacitance is equal to twice the value of either capacitor.

$$C_{eq} = C + C$$

$$\boxed{C_{eq} = 2C}\ \text{farad}$$

28. A capacitor capable of storing 1J of energy at -100 V dc supply. The value of capacitance will be?

(a) 100 μF (b) 200 μF

(c) 50 μF (d) 400 μF

BSNL JE (TTA) Junior Engineer Exam. 2015

Ans : (b) Energy stored in capacitor $= \frac{1}{2}CV^2$ Joule

$$1J = \frac{1}{2}C.(100)^2$$

$$C = \frac{2}{10^4}$$

$$C = 2\times10^{-4} \Rightarrow C = 200\times10^{-6}$$

$$\boxed{C = 200\mu F}$$

29. Electric charge in the capacitor-

(a) Stored in metal plates
(b) Stored in dielectric
(c) Both (a) and (b)
(d) Neither on the above

RRB Chandigarh Electronic – 2014

Ans : (b) The electric charge in the capacitor is stored in dielectric because when a dielectric material is placed between two plates. The charge gets store in dielectric material.

30. If a capacitor stores 100μC charge at 10 volts, the capacitance value is :

(a) 100μF (b) 1000μF
(c) 10μF (d) 1μF

KVS JE Electrical & Electronic-2016

Ans : (c) Given that -

$q = 100\ \mu C$, $V = 10$ Volt

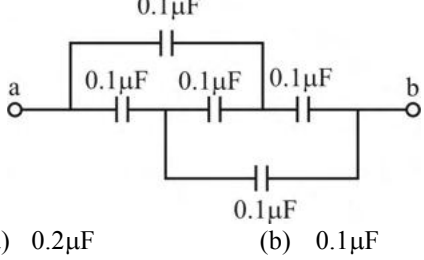
Then capacitance value of capacitor -

$$C = \frac{q}{V}$$

$$C = \frac{100\ \mu C}{10\ V}$$

$$C = 10\ \mu F$$

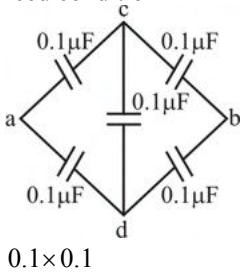
31. The equivalent capacitance across 'ab' will be :



(a) 0.2μF (b) 0.1μF
(c) 0.5μF (d) 0

(ISRO Electronic, 2006)

Ans : (b) In balanced condition -



$$C_{eq} = \frac{0.1\times0.1}{0.1+0.1} + \frac{0.1\times0.1}{0.1+0.1}$$

$C_{eq} = 0.05 + 0.05$

$\boxed{C_{eq} = 0.1\ \mu F}$

$\therefore$ Equivalent capacitance will 0.1μF.

32. 2 capacitor of 20μF and 40μF are connected in series across a 90V supply. After charging what will be the charge across each capacitor?

(a) 150μC (b) 100μC
(c) 270μC (d) 1200μC

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM

Ans. (d) : Equivalent capacitance of series connected capacitor -

$$C_{eq} = \frac{C_1.C_2}{C_1 + C_2} = \frac{20 \times 40}{20 + 40}$$

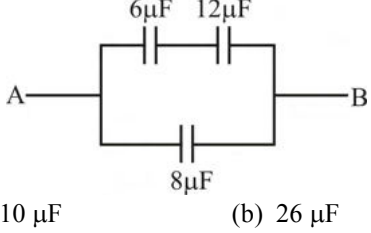
$$= \frac{800}{60}\mu F$$

$\therefore$ from $q = CV$

$$= \frac{800}{60} \times 90$$

$$\boxed{q = 1200\mu C}$$

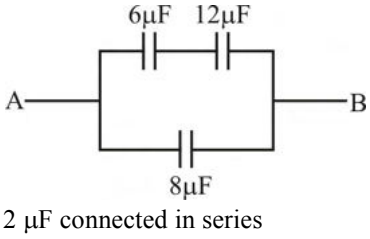
33. What will be the equivalent capacitance of the following circuit?



(a) 10 μF (b) 26 μF
(c) 18 μF (d) 12 μF

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (d) :

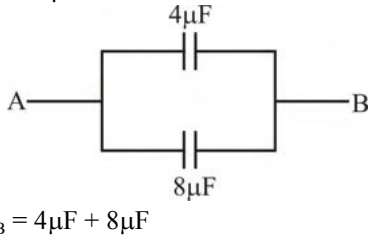


6 μF and 12 μF connected in series
So, Equivalent capacitance -

$$C_{eq} = \frac{6\mu F \times 12\mu F}{6\mu F + 12\mu F}$$

$$= \frac{72\mu F}{18}$$

$$= 4\mu F$$



$C_{AB} = 4\mu F + 8\mu F$
$= 12\mu F$

34. A capacitor having a capacitance of 40 μF is connected across 250 V DC source. The charging current will be least:

(a) initially
(b) when the capacitor is half charged

(c) when the capacitor is 25% charged
(d) when the capacitor is full charged

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM

Ans. (d) : When DC voltage applied across a capacitor. Initially it behaves like a short circuit. After some time voltage of capacitor will became equal to supply DC voltage. Then value of current will become zero and capacitor will behave like open circuit in steady state.

35. If a capacitor stores 0.12 C at 10 V, then its capacitance is–

(a) 0.024 F (b) 0.24 F
(c) 0.012 F (d) 0.6 F

RRB JE- 01.09.2019

Ans. (c) : Given that-

$q = 0.12C$
$V = 10V$
$\because \quad q = C.V$
$C = \frac{q}{V} = \frac{0.12}{10}$
$\boxed{C = 0.012F}$

36. Two ampere hour (Ah) is equal to how many coulombs?

(a) 2 C (b) 8400 C
(c) 7200 C (d) 2400 C

RRB JE- 01.09.2019

Ans. (c) : q = it = Ampere × Second = Coulomb
= 1 × 60 × 60 = 3600 Coulomb
∵ 1 Ah = 3600 coulombs
∴ 2 Ah = 3600 × 2
= 7200 coulombs

37. One farad is the same as :

(a) One coulomb/volt
(b) One joule/coulomb
(c) One joule/volt
(d) One coulomb/joule

Andhra Pradesh Telecom Circle- 2012

Ans. (a) : One farad is the same as one coulomb/volt.

$$C = \frac{q}{V} = \frac{\text{Coulomb}}{\text{Volt}} = \text{Farad}$$

38. If V, W and q stand for voltage, energy and charge respectively, then 'V' can be expressed as:

(a) $V = \frac{dq}{dw}$ (b) $V = \frac{dw}{dq}$
(c) $dV = \frac{dw}{dq}$ (d) $dV = \frac{dq}{dw}$

Andhra Pradesh Telecom Circle- 2012

Ans. (b) : If V, W and q stand for voltage, energy and charge respectively, then 'V' can be expressed as $V = \frac{dw}{dq}$.

39. The total energy stored in a capacitor is _____.

(a) CV (b) C^2V
(c) C/V (d) $1/2CV^2$

SSC IMD 25.11.2017 Evening

Ans. (d) : A capacitor stores energy in the form of an electric field that is established by opposite charges on the two plates.

$$E = \frac{1}{2}CV^2$$

40. If a current of 6A flows in a resistor, how much coulombs of charge pass through the resistor in two minutes?

(a) 12 (b) 720
(c) 120 (d) 760

Gujarat Telecom Circle- 2012

Ans. (b) : Given that - I = 6A

t = 2 minute = 120 second

$\because$ Q = i × t

= 6 × 120

Q = 720 C

41. A pellet carrying a charge of 0.5C is accelerated from rest through a p.d. of 2000V,it attains K.E. of-

(a) 1000J (b) 1000 KW-hr
(c) 1000eV (d) zero

BSNL JE (TTA) Junior Engineer Exam. 2015

Ans : (a) Potential $(V) = \frac{W}{Q}$

$$2000 = \frac{W}{0.5}$$

$$W = 2000 \times 0.5$$

$$W = 1000\,J$$

42. The energy required to move 60 coulomb charge through a potential difference of 1.5V is

(a) 6.2 mJ (b) 90 J
(c) 10 J (d) 0.695 mJ

ISRO: VSSC TA (EC) 25.02.2018

Ans : (b) $\because$ Given that -

Q = 60 C

V = 1.5V

Energy (W) = QV = 60 × 1.5 = 90 J

43. One coulomb per second is equal to:

(a) 1 nano Ampere (b) 1 micro Ampere
(c) 1 mili Ampere (d) 1 Ampere

DSSSB -2019

Ans. (d) : Q = it

$$i = \frac{Q}{t}$$

Where, i = Current, Q = Charge, t = Time

$$1A \text{ Current} = \frac{1 \text{Coulomb}}{1 \text{ Second}} = 1 \text{ Coulomb/second}$$

44. When plate separation of a condenser, having charge Q and capacitor C is doubled. The work done will be

(a) $\frac{Q^2}{4C}$ (b) $\frac{Q^2}{2C}$ (c) $\frac{Q^2}{C}$ (d) $\frac{2Q^2}{C}$

Madhya Pradesh Telecom Circle-2012
West Bengal Telecom Circle-2008

Ans. (c) : Work done = Capacitive energy = $\frac{1}{2}\frac{Q^2}{C}$

$$\therefore W_1 = \frac{1}{2}\frac{Q_1^2}{C_1} \text{ and } W_2 = \frac{1}{2}\frac{Q_2^2}{C_2}$$

$$\therefore \boxed{\frac{W_2}{W_1} = \left(\frac{Q_2}{Q_1}\right)^2\left(\frac{C_1}{C_2}\right)}$$

Given that $\Rightarrow Q_2 = 2Q_1$ and $C_2 = 2C_1$

$$\therefore W_2 = \left(\frac{2Q_1}{Q_1}\right)^2\left(\frac{C_1}{2C_1}\right)W_1$$

$$\boxed{W_2 = 2W_1}$$

$$= 2 \times \frac{1}{2}\frac{Q_1^2}{C_1}$$

$$W_2 = \frac{Q_1^2}{C_1}$$

45. In a parallel plate capacitor capacitance is inversely proportional to:

(a) Length of plates
(b) Dielectric constant
(c) Area of plates
(d) Spacing between the two plates

DSSSB -2019

Ans. (d) : Parallel plate capacitance

$$\boxed{C = \frac{\varepsilon_0 A}{d}}$$

C = Capacitance
A = Area
d = Distance between two plates

$\boxed{C \propto A} \rightarrow$ directly proportional

$\boxed{C \propto \frac{1}{d}} \rightarrow$ Inversely proportional

46. A 50 μF capacity is charged to retain 10 mJ of energy by a constant charging current of 1A. Determine the voltage across the capacitor

(a) 20 (b) 10
(c) 50 (d) 5

Gujarat Telecom Circle- 2012

Ans. (a) : Given that -

$$E = 10\text{mJ} = 10 \times 10^{-3}\text{J}$$

$$C = 50\mu\text{F} = 50 \times 10^{-6}\text{F}$$

Formula from $\boxed{E = \frac{1}{2}CV^2}$ -

$$V = \sqrt{\frac{2E}{C}} = \sqrt{\frac{2 \times 10 \times 10^{-3}}{50 \times 10^{-6}}} = \sqrt{20 \times 20}$$

V= 20 Volt

47. A capacitor stores 0.15C at 5V. Its capacitance is

(a) 0.75 F (b) 0.75 μF
(c) 0.03F (d) 0.03μF

SAIL-2019

Ans. (c) : Given-
q = 0.15C, V= 5V
Formula, q = C.V

$$C = \frac{q}{V} = \frac{0.15}{5}$$

$$\boxed{C = 0.03 \text{ Farad}}$$

48. If the potential difference between two points in a circuit is 'V', the work done is moving a charge 'Q' from lower potential to higher potential is

(a) V/Q (b) VQ
(c) Q/V (d) V^2/Q

ISRO VSSC TA (EC) 14.07.2021

Ans. (b) : Given,
Potential difference = V
Charge = Q

$$V = \frac{W}{Q}$$

$$\boxed{W = V \times Q}$$

Work done $= V \cdot Q$

49. Permittivity is expressed in terms of

(a) Newtons/metre (b) Webers/metre
(c) Farads/metre (d) Farads/sq. metre

Andhra Pradesh Telecom Circle- 2012

Ans. (c) : Permittivity is expressed in terms of farad/meter. for capacitor-

$$C = \frac{\varepsilon A}{d}$$

$$\varepsilon = \frac{Cd}{A}$$

So, Unit of permittivity is F/m.

50. The capacitance between two plates increase with-

(a) Larger plate area and shorter distance between plates
(b) Shorter plate area and shorter distance between plates
(c) Shorter plate area and higher applied voltage
(d) Larger plate area and larger distance between plates

Chennai Telephone- 2010

Ans. (a) : The capacitance between two plates increase with larger plate area and shorter distance between plates. Capacitance denoted by 'C'.

$$C = \varepsilon_0 \frac{A}{d}$$

ε_0 = Permittivity of free space (8.854×10^{-12}F/m)
A = Area
d = Distance between plates.

51. If the distance between two charged bodies is made half, the force between them becomes

(a) One fourth (b) Double

(c) Half (d) None of the above

Calcutta Telephones- 2010

Ans. (d) : Force between the two charge proportional to the product of the charge and inversely proportional to the square of distance between them

$$F = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{r^2}$$

where, $\frac{1}{4\pi\varepsilon_0} = K$

$$\therefore \quad F = K.\frac{q_1 q_2}{r^2}$$

Given that, $r' = \frac{r}{2}$

$$F' = K.\frac{q_1 q_2}{\left(\frac{r}{2}\right)^2}$$

$$F' = 4K.\frac{q_1 q_2}{r^2}$$

$$F' = 4F$$

So, the force between them become 4 times of initial value.

52. The potential inside a charged hollow sphere is

(a) Zero

(b) Same as that on the surface

(c) Less than that on the surface

(d) Greater than that on the surface

West Bengal Telecom circle-2008

Ans. (b) : The potential inside a charged hollow sphere is same as that on the surface. The electric field inside a conducting sphere is zero. The electric field is equal to the rate of change of potential that the voltage inside a conductor at equilibrium is constant at the value it reaches the surface of the conductor.

$$\boxed{E = \frac{D}{\varepsilon_0} = 0}$$

$$\because V_1 - V_2 = 0$$

$$V_1 = V_2$$

53. If two conductors carry current in the same direction

(a) Conductors attract each other

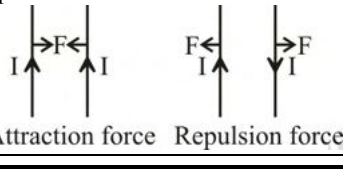
(b) Conductors are in resonance

(c) Conductors repel each other

(d) Voltage between two conductors increases

RRB SSE Bilaspur Yellow paper, 21.12.2014

Ans : (a) If two conductor carry current in the same direction conductor attract each other and when two conductor carry current in the opposite direction conductor repel each other



Attraction force Repulsion force

54. The capacitance C of a spherical conductor of radius R is proportional to

(a) R^2 (b) R^3

(c) 1/R (d) R

Calcutta Telecom Circle-2012

Ans. (d) : The capacitance C of a spherical conductor of radius R,

$C = 4\pi\varepsilon_0 R$

$\therefore C \propto R$

Where, $R \rightarrow$ radius of sphere

So, The capacitance (C) of a spherical conductor is proportional to 'R'.

55. The electric flux and field intensity inside a conducting sphere is

(a) Minimum (b) Maximum

(c) Uniform (d) Zero

Calcutta Telephones- 2010

Ans. (d) : The electric flux and field intensity inside a conducting sphere is zero. According to Gauss law, the electric field inside a conducting sphere is always zero irrespective of how much charge resides on its surface. Due to zero electric field inside a sphere the electric flux inside a sphere is zero.

56. An inductor stores energy in :

(a) electrostatic field

(b) electromagnetic field

(c) core

(d) magnetic field

LMRC JE Electronics 2016

Ans : (d) An inductor stores energy in magnetic field.

Store energy in inductor $= \frac{1}{2}LI^2$

- It resists changes in current
- The current in an inductor doesn't change instantaneously.
- The unit of inductance is henry.

57. Two charges are placed at a distance apart. Now, if a glass slab is inserted between them, then the force between the charges will:-

(a) Reduce to zero (b) Increase

(c) Decrease (d) Not change

UPPCL A.E. Electrical, 12.11.2016

Ans : (c)

$$F_1 = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$$

$$F_2 = \frac{1}{4\pi\varepsilon_0\varepsilon_r}\frac{q_1q_2}{r^2}$$

$$F_2 = \frac{F_1}{\varepsilon_r}$$

$$F_2 < F_1$$

58. Value of constant k (F/m) in Coulomb's law has value of-

(a) 9×10^4 (b) 9×10^5

(c) 9×10^6 (d) 9×10^9

BSNL JE (TTA) 28.09.2016, 3 PM

Ans. (d) Coulomb's law- According to this law the force of attraction or repulsion between two charged bodies is directly proportional to the product of their

charges and inversely proportional to the square of distance between them.

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{d^2}$$

$$\left(\because k = \frac{1}{4\pi\varepsilon_0}\right)$$

$$\therefore F = k.\frac{q_1 q_2}{d^2}$$

Value of constant (k) = 9×10^9.F/m

59. The value of relative permittivity of vaccum is

(a) 1 (b) 0

(c) 8.854×10^{-12} (d) ∞

BSNL TTA (JE) 2015

Ans. : (a) Relative permittivity is the ratio of the permittivity of a substance to the permittivity of space or vacuum.

$$\boxed{\varepsilon_r = \frac{\varepsilon}{\varepsilon_0}}$$

Where, $\varepsilon_r \rightarrow$ relative permittivity

$\varepsilon \rightarrow$ absolute permittivity

$\varepsilon_0 \rightarrow$ Permittivity of vacuum

The value of relative permittivity of vacuum is 1.

60. Electric field is defined as-

(a) Potential per unit distance

(b) Force per unit charge

(c) Voltage per unit current

(d) None of these

BSNL (TTA) 27.09.2016, 3 pm

Ans : (b) Electric field is defined as the electric force per unit charge.

$$(E) = \frac{F}{Q} \text{ Newton/coulomb}$$

Where, $E \rightarrow$ Electric field

$F \rightarrow$ Force

$Q \rightarrow$ Charge

$$\boxed{E = \frac{1}{4\pi\varepsilon}\frac{q}{r^2}} \text{ N/C}$$

61. Electric field is a

(a) Scalar quantity

(b) Vector quantity

(c) Both scalar quantity & vector quantity

(d) None of these

ISRO : PCM TA (EC) 21.04.2018

BSNL (TTA) 27.09.2016, 3 pm

Ans : (b) Electric field is a vector quantity because it has both magnitude and direction. The electric field is a ratio of electric force and charge. The charge is a scalar quantity but the electric force is a vector quantity and therefore the electric field has magnitude and direction both.

$$\left[\vec{E} = \frac{\vec{F}}{Q}\right]$$

62. The force of attraction between two charge particles is

(a) Directly proportional to the amount of charge
(b) Inversely proportional to amount of charge
(c) Directly proportional to size of the charged particles
(d) None of these

BSNL (TTA) 29.09.2016, 10 AM

Ans : (a) Coulomb's law- According to this law the force of attraction or repulsion between two charge bodies is directly proportional to the product of their charge and inversely proportional to the square of the distance between them.

$$\boxed{F = k\frac{q_1 q_2}{r^2}}$$

Where, $\left[k = \frac{1}{4\pi\varepsilon}\right]$

63. The force between two point charges of 1C each separated by a distance 3m in free space is

(a) 9×10^9 N
(b) 9×10^{-9} N
(c) 3×10^9 N
(d) 10^9 N

BSNL TTA (JE) 2015

Ans. : (d) Given,

d = 3 m, q=1C

$$\because F = 9\times10^9 \times \frac{q_1 q_2}{d^2}$$

$$F = \frac{1}{9}\times 9\times 10^9$$

$F = 10^9$N

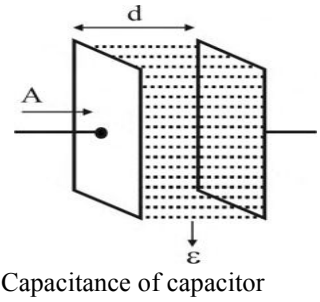
64. Which of the following is not a factor on which the capacitance of a parallel plate capacitor depends?

(a) Area of plates
(b) Medium between plates
(c) Distance between plates
(d) Materials of plates

DMRC Electronics 19.04.2018, 12:15 to 2:30 PM

Ans. (d) : $C = \frac{\varepsilon A}{d}$

$$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$



Where, C = Capacitance of capacitor
ε = Permittivity
A = Area of plate
d = Distance between plate

Thus the capacitance of parallel plate capacitor does not depend on material of plate.

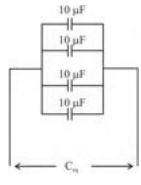
65. If four 10μF capacitors are connected in parallel, the net capacitance is:

(a) 2.5 μF (b) 40 μF

(c) 20 μF (d) 1/40 μF

UPPCL (TG-2) 10.11.2023, Shift-I
UPPCL (TG-2) 17.11.2023, Shift-II
ISRO (VSSC) Technician (B) 21.02.2015

Ans. (b) : If four 10 μF capacitors are connected in parallel, the net capacitance is 40 μF.



$C_{eq} = 10 + 10 + 10 + 10$

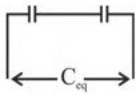
$C_{eq} = 40$ μF

- Equivalent capacitor in parallel combination

  $[C_{eq} = C_1 + C_2 + C_3 + ... C_n]$

- Equivalent capacitors in series combination.

$$\left[C_{eq} = \frac{C_1C_2}{C_1 + C_2}\right]$$



- A capacitor is a passive electronic component which is store energy in the form of electric field
- It consist of two electrical conductors that are separated by a distance. The space between the conductor filled by insulating material known as dielectric medium.

$$\boxed{C = \frac{\varepsilon_o \varepsilon_r A}{d}} \quad \varepsilon_o = 8.854 \times 10^{-12} \text{ Farad/meter}$$

Where,

$\varepsilon_o \rightarrow$ Absolute permittivity

$\varepsilon_r \rightarrow$ Relative permittivity

$A \rightarrow$ Area of the conducting plate

$d \rightarrow$ distance between two plate

Stored energy in capacitor $(E) = \frac{1}{2}CV^2$ Joule.

66. A capacitor which is charged to 10V, stores 1 coulomb of charge. Find the capacitance.

(a) 0.1 F (b) 0.1 μF

(c) 1 μF (d) 1 F

UPPCL (TG-2) 17.11.2023, Shift-I
UPPCL (TG-2) 07.11.2023, Shift-II
UPRVUNL (TG-2) 21.12.2022, Shift-II

Ans. (a) : Given that,

V = 10 volt, Q = 1 coulomb

From $\boxed{C = \frac{Q}{V}}$

$$C = \frac{1}{10} = 0.1 \text{ F}$$

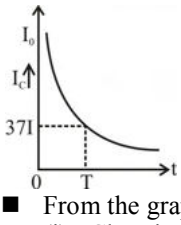
67. When the capacitor is fully charged after connecting it to voltage source in a DC circuit, then the current in the circuit____.

(a) increases (b) it remains constant

(c) falls to zero (d) decreases

CPRI Technician Grade- I, 31.07.2023,

Ans. (c) : When the capacitor is fully charged after connecting it to voltage source in a DC circuit, then the current in the circuit falls to zero.



- From the graph of charging condition of capacitor.
  (i) Charging current I_c is maximum at start i.e. when capacitor is uncharged.
  (ii) As time increases, charging current decreases exponentially and becomes zero when $t = \infty$ i.e. in about 5 time constant.
- Under steady state condition, the circuit appears only as a capacitor which means it act as an open-circuit.

$$\boxed{I_c = I_0 e^{-t/\tau}}$$

68. Which of the following is an example of a variable capacitor?
(a) Mica capacitor
(b) Air capacitor
(c) Ceramic capacitor
(d) Electrolytic capacitor

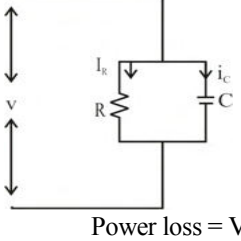
MPESB Electrician 22.12.2022

Ans. (b) : Air capacitor is an example of a variable capacitor.
Example:- Air Capacitor, Tuning Capacitor, Trimmer Capacitors.

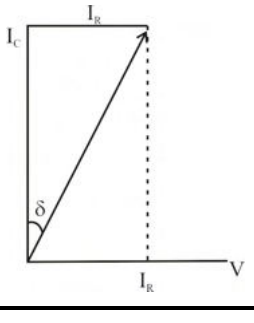
69. When a dielectric is subjected to ac voltage the electrical energy is absorbed by the material this energy is called as:
(a) Dielectric loss (b) Heat loss
(c) Magnetic loss (d) Electrical power loss

UPRVUNL (TG-II) 21.12.2022, Shift-I

Ans. (a) : When a dielectric is subjected to ac voltage the electrical energy is absorbed by the material. This energy is called as dielectric loss.
Dielectric loss- The dielectric material of the cable can be represented as RC Parallel circuit.



Power loss = $V \times I_R$
The phase diagram for the above circuit is shown below.



$$\tan\delta = \frac{I_R}{I_C}$$

$$I_R = I_C \tan\delta$$

$$I_C = \frac{V}{X_c} = \omega CV$$

$$I_R = \omega CV\tan\delta$$

$$\text{Power loss} = V \times I_R = V\,\omega CV\tan\delta$$

$$\boxed{\text{Power loss} = V^2\omega C\tan\delta}$$

70. The dielectric constant of mica is approximately ..... that of air.

(a) Same as (b) 10 times

(c) Twice (d) 5 times

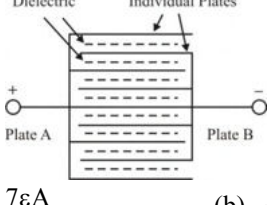
UPRVUNL (TG-2) 21.12.2022, Shift-II

Ans. (b) : The dielectric constant of mica is approximately 10 times that of air.

Material	Dielectric constant or relative permittivity
Air	1
Impregnated paper	1.8-2.6
Rubber	2.5-4
Bakelite	5
Glass	5-12
Mica	4-8

Dielectric Strength–Maximum potential difference which a unit thickness of the medium can withstand without breakdown is called Dielectric Strength.

71. Effective capacitance of (C) the above multi capacitor (each plate area is A and distance between two plates is d is:)

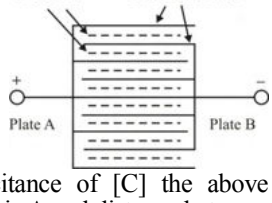


(a) $C = \frac{7\varepsilon A}{d}$ (b) $C = \frac{10\varepsilon A}{d}$

(c) $C = \frac{9\varepsilon A}{d}$ (d) $C = \frac{8\varepsilon A}{d}$

UPRVUNL TG-2 22.12.2022, Shift-II

Ans. (a) :



effective capacitance of [C] the above multi-capacitor [each plate area is A and distance between two plates is d]

$$\text{Effective capacitance of multi-capacitor} = \frac{(n-1)\varepsilon_0\varepsilon_r A}{d}$$

No. of plate (n) = 8

A = Plate area

$$= \frac{(8-1)\varepsilon A}{d} = \frac{7\varepsilon A}{d}$$

72. Which of the following is a polarized capacitor?

(a) Electrolyte's (b) Mica
(c) Polystyrene (d) Plastic film

UPRVUNL TG-2 22.12.2022, Shift-II

Ans. (a) : Electrolyte's capacitor is a type of polarized capacitor. A polarized capacitor is one that has a voltage applied to it in a specific polarity. This capacitor allows the flow of current in a particular direction.

- Tantalum electrolytic capacitor is a type of polarized capacitor.
- A non-polarized capacitor is one that has no fixed polarity, non-polarized capacitor allows the flow of current in both direction.
- Dielectric, ceramic and film types are non-polarized capacitors.

73. The unit of capacitance is

(a) Volts/Coulombs (b) Coulombs/Volt
(c) Ohm-meter (d) None of these

KPSC Electrician– 07.05.2022

Ans. (b) : The unit of capacitance is Coulombs per volt

$$C = \frac{q}{V} \text{ Coulombs/volt}$$

- The unit of resistivity is ohm-meter.

$$\rho = R\frac{A}{l} \text{ ohm-meter}$$

74. The capacitance of a capacitor is not affected by

(a) Thickness of the plates
(b) Distance between plates
(c) Area of plates
(d) None of these

KPSC Electrician– 07.05.2022

Ans. (a) : The capacitance of a capacitor is not affected by thickness of the plates.

Capacitance affected by–

$$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$

where, C = Capacitance
ε_0 = permittivity of free space
ε_r = relative permittivity
A = Area of plate
d = Distance between plates

75. Capacitors should be discharged ……. ?

(a) Through conductor
(b) With one pole earthed
(c) Resistor
(d) With two pole earthed

ISRO (SDSC) Technician (B) 04.06.2022, 4:30-6:30PM

Ans. (c) : Capacitors should be discharged through the resistor.

- If the direction of charging current is taken positive, then that of the discharging current will be taken as negative.

$$i_c = -I_0 e^{-\frac{t}{\tau}} \text{ ampere}$$

76. A capacitor of capacitance 50 micro farads is charged to a potential difference of 200 Volts. Find out energy stored in the condenser ?

(a) 1 joule (b) 100 milli joule
(c) 10 milli joule (d) 100 joule

ISRO (URSC) Technician (B) 27.11.2016

Ans. (a) : If a capacitor of capacitance 50 μF is charged to a potential difference of 200 volts. Then energy stored in the condenser will be 1 Joule.

Solution - Given data is,

$C = 50\mu F = 50\times10^{-6}F$

$V = 200$ Volts

Energy = ?

As we know, from energy equation of capacitor is -

$$E = \frac{1}{2}CV^2$$

$$E = \frac{1}{2}\times50\times10^{-6}\times200\times200$$

$E = 1$ Joule

77. The capacitance of the capacitor is directly proportional to the .....

(a) Material of the plate
(b) Area of the plate
(c) Voltage across the plate
(d) Polarity of the plates

ISRO (URSC) Technician (B) 27.11.2016

Ans. (b) : The capacitance of the capacitor is directly proportional to area of the plate.

$$\boxed{C = K\frac{\varepsilon_o\varepsilon_r A}{d}}$$

- Capacitance is inversely proportional to the distance between plates.

$$\boxed{C = \frac{Q}{V}}$$

- The property of a capacitor to 'store electricity' may be called its capacitance.

78. The change in a 4 μF capacitor charged to 100 V will be:

(a) 4 μC (b) 25 μC
(c) 100 μC (d) 400 μC

ISRO (VSSC) Technician (B) 21.02.2015

Ans. (d) : The change in a 4μF capacitor charged to 100V will be 400 μC.

$\because q = CV$

$= 4\times10^{-6}\times100 = 400\times10^{-6} = 400\ \mu C$

79. The potential difference across a 10μF capacitor to charge it with 10mC is:

(a) 10 V (b) 1 kV
(c) 1 V (d) 10 V

ISRO (SAC) Technician (B) 06.11.2016

Ans. (b) : Given,

Capacitance = 10μF

Charge = 10mC

$q = cv$

$$V = \frac{q}{c} \qquad V = \frac{10\times10^{-3}}{10\times10^{-6}} \qquad V = \frac{10\times10^{3}}{10}$$

$$\boxed{V = 1kV}$$

80. A capacitor consists of two

(a) insulation separated by a dielectric
(b) conductors separated by an insulator
(c) ceramic plates and one mica disc
(d) Silver-coated insulator

ISRO (SAC) Technician (B) 06.11.2016

Ans. (b) : A capacitor consist of two conductor separated by an insulator.

- Capacitance is the ratio of the charge on one plate of a capacitor to the voltage difference between the two plates, measured in farads (F).

$$1 \text{ Farad} = 1 \text{ Columb/Volt}$$

- A capacitor is an open circuit to d.c.
- While a capacitor charge and discharge polarity of d.c voltage of capacitor never change.

81. which one of the following capacitors are usable only for DC?

(a) Aluminium foil capacitor
(b) Metallic paper capacitor
(c) Poled Aluminium-electrolyte capacitor
(d) Ceramic capacitor

ISRO (VSSC) Technician (B) 25.09.2016

Ans. (c) : Poled-Aluminium electrolyte capacitors are usable only for DC.

Electrolyte capacitor- An electrolytic capacitor is a polarized capacitor whose anode or positive plate in made of a metal that forms an insulating oxide layer through ionization. This oxide layer acts as the dielectric of the capacitor.

82. Permittivity of air is ----------

(a) 885×10^{-12} Farad/meter
(b) 8.85×10^{-12} Farad/ meter
(c) 8.85×10^{-6} Farad/ meter
(d) 885×10^{-6} Farad/ meter

ISRO IPSC Tech-B 22.04.2018

Ans. (b) : The permittivity of free space is a physical constant that the ability of electrical field to pass through a classical vacuum. The constant is equal to approximately 8.85×10^{-12} f/m (farad per meter) the value of absolute permittivity is $8.85\times10^{-12}\ C^2\ N^{-1}m^{-2}$

83. The equivalent of one picofarad is

(a) 10^{12}F (b) $1/10^{12}$
(c) 10^{-9}F (d) $1/10^{6}$ F

KPSC Electrician -30.09.2020

Ans. (b) :

one picofarad is 10^{-12}F.

i.e. one picofarade $= \frac{1}{10^{12}}$ F.

- Farad is the unit of capacitance
- The farad is defined as the capacitance of a capacitor that has a potential difference of one volt when charged by one coulomb of electricity.

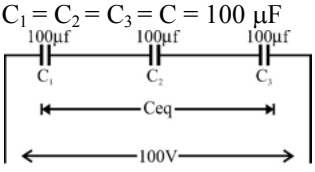
84. Three capacitors each of 100 Micro farad are connected in series across 100 v supply there equivalent capacitance is

(a) 66.66 Micro farad (b) 300 Micro farad
(c) 33.33 Micro farad (d) 100 Micro farad

KPSC Electrician -30.09.2020

Ans. (c) : Given

$C_1 = C_2 = C_3 = C = 100\ \mu F$



$$\frac{1}{Ceq} \quad \frac{1}{C_1} \quad \frac{1}{C_2} \quad \frac{1}{C_3}$$

$$Ceq \quad \frac{C_1C_2C_2}{C_1C_2 \quad C_2C_3 \quad C_3C_1}$$

$$Ceq \quad \frac{100 \quad 100 \quad 100}{100 \quad 100 \quad 100 \quad 100 \quad 100 \quad 100}$$

$$Ceq \quad \frac{10^6}{10^4 \quad 10^4 \quad 10^4} \quad \frac{100}{3}$$

$$\boxed{Ceq \quad 33.3 \ F}$$

85. What is/are the unit(s) of electrical energy?

(a) Joule (b) Electron-volt

(c) Kilowatt-hour (d) All of these

IREL Electrician Tradesman-04.09.2022

Ans. (d) : Unit of electrical energy.

i. Joule.

ii. Electron - Volt

iii. Kilo- Watt- hour

iv. Unit

- 1 kWh = 1 Unit
- One kWh is also called board of trade.

86. Which of the following is not a vector quantity?

(a) Electric potential (b) Electric field

(c) Angular momentum (d) Linear momentum

IREL Electrician Tradesman-04.09.2022

Ans. (a) : Electric potential is not a vector quantity.

Scalar quantity:-A scalar quantity is a physical quantity with only magnitudes such as mass, electric charge and electric potential.

Vector Quantity:-A vector quantity is a physical quantity that has both magnitudes and direction like force weight electric field, Angular momentum, linear momentum.

87. Capacitance may be given in-

(a) Micro-farads (b) Nano-farads

(c) Pico-farads (d) Farads

(e) All of the options

JVVNL Technical Helper-02.11.2022, 12:00-14:00 PM

Ans. (e) : Capacitance may be given in micro - farads, Nano- Farads, Pico- Farads

Micro - farads	10^{-6}
Nano - farads	10^{-9}
Pico - farads	10^{-12}

88. In capacitance color coding, what is the first digit value of the brown color?

(a) 0 (b) 1

(c) 2 (d) 3

(e) 4

JVVNL Technical Helper-02.11.2022, 12:00-14:00 PM

Ans. (b) : In capacitance color coding 1 is the first digit value of the brown color.

Band color	Digit-A	Digit- B	Multiplier-D	Tolerance
Black	0	0	1	± 20%
Brown	1	1	10	±1%
Red	2	2	100	±2%
Orange	3	3	1000	±3%
Yellow	4	4	10,000	±4%
Green	5	5	100,000	±5%
Blue	6	6	1000,000	
Violet	7	7		
Gray	8	8	0.01	±8%
White	9	9	0.01	**±10%**
Gold			0.01	±5%
Silver			0.01	±10%

89. Which of the following statement is false in case of coulomb's law?

(a) Force is along the line joining the charge

(b) $F \propto \frac{1}{R^2}$

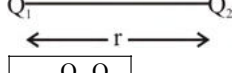
(c) $F \propto E^3$

(d) $F \propto Q_1Q_2$

GAIL Technician (Telecom & Telemetry)-21.11.2022, 09:00-10:30AM

Ans.(c) $F \propto E^3$ is false statement in case of coulomb's law.

Coulomb's law:- Coulomb's law states that the force of attraction or repulsion between two charged bodies is directly proportional to the charges and inversely proportional to the square of distance between them.



$$F \propto \frac{Q_1 Q_2}{r^2}$$ Newton

$$F = K\frac{Q_1Q_2}{r^2} = \frac{1}{4\pi\varepsilon_0\varepsilon_r}\frac{Q_1Q_2}{r^2}$$

Where, $k = \frac{1}{4\pi\varepsilon_0} = \text{Constant}$

$\varepsilon_0 = 8.854 \times 10^{-12}\ C^2/Nm^2$ or Fm^{-1}

90. Which of the following capacitors is/are used as a tuned circuit capacitor?

(a) Paper capacitor

(b) Electrolytic capacitor

(c) Ceramic capacitor

(d) Polystyrene capacitor

(e) All of the options

JVVNL Technical Helper-27.08.2022,12:00-2:00PM

Ans. (d) : Polystyrene capacitor is used as Tunnel circuit capacitor.

- Polystyrene capacitors are capacitors that have a dielectric made up of polystyrene.
- Working Voltage for polystyrene capacitors are 30V to 630V.
- Polystyrene capacitors are constructed like a coil inside, So they are not suitable for high frequency application.

91. Which of the following is a passive type of electronic component?

(a) Transistor (b) Photodiode
(c) Capacitor (d) Vacuum Tube

JMRC Maintainer Electronics-05.02.2021

Ans. (c) : Capacitor is a passive type electronic component.
Active Component - Diode, transistor DIAC, TRIAC and semiconductor device.

92. What type of capacitor is shown in the following figure?

(a) Film type capacitor
(b) Dielectric capacitor
(c) Electrolytic capacitor
(d) Ceramic capacitor

UPPCL TG-2, 28.03.2021 Shift II

Ans (c) :Electrolytic capacitor is shown in the figure.

- An electrolytic capacitor is a polarized capacitor whose anode or positive plate is made of a metal that forms an insulating oxide layer through anodizing. This oxide layer acts as the dielectric of the capacitor. Range of electrolytic capacitor is 1μF to 1000μF and voltage range of 1 V to 500 V.
- It works on the D.C. supply.
- Mostly used in filter circuit.

93. How can increase the value of capacitance?

(a) Increasing in area
(b) Increases in distance between plate
(c) Decreasing in flux
(d) Decrease in area

UPPCL TG-2, 19.03.2021 Shift II

Ans : (a) The value of capacitance increases by increasing in area.

$$C = \frac{\varepsilon_0 A}{d} \qquad \varepsilon_r = 1(\text{Medium air})$$

$$\boxed{C \propto A}$$

- Capacitance is directly proportional to area.
- Capacitance is inversely proportional to distance between plates.
- Capacitance of different Dielectric martial having different thickness and relative permittivity's.

$$\boxed{C = \frac{\varepsilon_0 A}{\frac{t_1}{\varepsilon_{r_1}} + \frac{t_2}{\varepsilon_{r_2}} + \frac{t_3}{\varepsilon_{r_3}}}}$$

- Capacitance of cylindrical Capacitor

$$\boxed{C = \frac{2\pi\varepsilon_0\varepsilon_r l}{l\,n\left(\frac{R}{r}\right)}}$$

l= length of cable
R= Radius of insulation
r = Radius of conductor

- Dimension of capacitance [$M^{-1}L^{-2}T^4A^2$]

94. What will be the capacitive reactance of a 50μF capacitor at a frequency of 100 Hz?

(a) 37.83 Ω (b) 24.67 Ω
(c) 31.84 Ω (d) 29.26 Ω

UPPCL TG-2, 19.03.2021 Shift II

Ans : (c) Given that,
Supply frequency (f) = 100 Hz
Capacitance (c) = 50μF=50×10^{-6}F
Capacitive Reactance (X_C)=?

Formula $\boxed{X_C = \frac{1}{2\pi fC}}$

$$X_C = \frac{1}{2\pi\times100\times50\times10^{-6}}$$

$$X_C = \frac{0.3184\times10^{6}}{100\times100}$$

$$X_C = 0.3184\times10^{2}$$

$X_C = 31.848\ \Omega$

95. 50-μF Capacitor is connected to a 230V, 50Hz supply. Find the value of maximum current.

(a) 63.6 A (b) 5.11 A
(c) 6.36 A (d) 3.62 A

UPRVUNL TG-2, 14.07.2021 Shift II

Ans. (b) : Given that,
C = 50 μF, f = 50 Hz, V = 230 volt
I_m = ?

Formula-

$$\boxed{I_m = \frac{V_m}{X_C}} \quad (V_{max} = V_{rms}\sqrt{2})$$

$$I_m = 230\sqrt{2}\times\omega C$$

$$= 230\sqrt{2}\times2\pi fC$$

$$= 230\times1.414\times2\times3.14\times50\times10^{-6}\times50$$

$$= 5105\times10^{-3}$$

$$\boxed{I_m = 5.105\,A}$$

96. In S.I system, basic unit of electric charge is?

(a) Volt (b) Celsius
(c) Coulombs (d) Ampere

UPRVUNL TG-2, 14.07.2021 Shift I

Ans (c) : S.I unit of electric charge is coulombs.

$$\boxed{q = it}$$

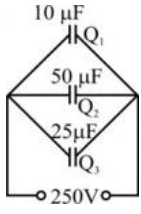
Another unit of charge is ampere Second or joule per volt.

97. In a given circuit, find the value of Q_1 (all capacitor are in microfarad).

(a) 2.5 Micro coulombs
(b) 2500 Micro coulombs
(c) 25 Micro coulombs
(d) 250 Micro coulombs

UPRVUNL TG-2, 14.07.2021 Shift I

Ans (b) :



∵All capacitor are connected in parallel then voltage across each capacitor is same as (250V).

Formula, $\boxed{Q = CV}$

$$Q_1 = 10\times10^{-6}\times250$$

$$\boxed{Q_1 = 2500\ \mu C}$$

98. What is the definition of capacitance?

(a) Charge × Charge (b) Voltage × Voltage
(c) Voltage / Charge (d) Charge/ Voltage

UPRVUNL TG-2, 14.07.2021 Shift I

Ans (d) : The amount of charge required to create a unit potential difference between its plates.
Suppose we give Q coulomb of charge to one of the two plate of capacitor and if a potential difference of V volts is established between the two, then its capacitance is-

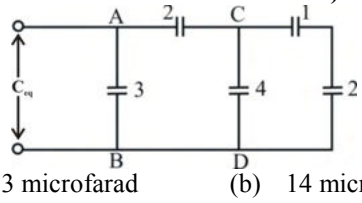
$$\boxed{C = \frac{Q}{V} = \frac{\text{Charge}}{\text{Potential difference}}}$$

Unit of capacitance is coulomb/volt.

$$\boxed{1\,\text{Farad} = 1\,\text{coulomb/volt}}$$

■ Capacitance is that property of a capacitor which oppose any change of voltage across it.

99. Find the value of C_{eq} for the following diagram (the values of 'C' is in microfarad):



(a) 3 microfarad (b) 14 microfarad
(c) $\frac{3}{14}$ microfarad (d) $\frac{14}{3}$ microfarad

UPRVUNL TG-2, 14.07.2021 Shift I

Ans (*) :Capacitance between C and D

$$= 4 + 1 \parallel 2$$

$$= 4 + \frac{1\times2}{1+2} = \frac{14}{3}\mu F$$

Capacitance between A and B

$$C_{eq} = 3 + 2 \parallel \frac{14}{3} = 3 + \frac{2\times\frac{14}{3}}{2+\frac{14}{3}} = \frac{22}{5} = 4.4\,\mu F$$

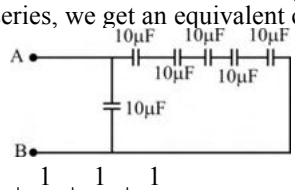
Note- Given by the commission is correct option (d).

100. What is the minimum number of capacitors needed to make an equivalent capacitance of 12μF, with only 10μF capacitor are available.

(a) 2 (b) 6
(c) 5 (d) 12

UPPCL TG-2, 20.03.2021 Shift I

Ans (c) : Where 5 number of 10μF capacitors connected in series, we get an equivalent capacitance of,



$$\frac{1}{C_{eq}} = \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10}$$

$C_{eq} = 2\mu F$

C_{eq} = 2μF connected in parallel with 10μF capacitors the equivalent capacitance becomes

$C_{eq} = 10+2$

$\boxed{C_{eq} = 12\ \mu F}$

101. Two capacitors of 4pF each are connected in series. Their total capacitance is .....

(a) 4 pF (b) 8 pF
(c) 16 pF (d) 2 pF

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (d) : Given that, $C_1 = 4pF$
$C_2 = 4pF$

Since the capacitors are connected in series their equivalent capacitor is-

$$\boxed{\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + ... + \frac{1}{C_n}}$$

$$\frac{1}{C_{eq}} = \frac{1}{4} + \frac{1}{4} = \frac{2}{4}$$

$$\frac{1}{C_{eq}} = \frac{4}{2}$$

$$C_{eq} = 2pF$$

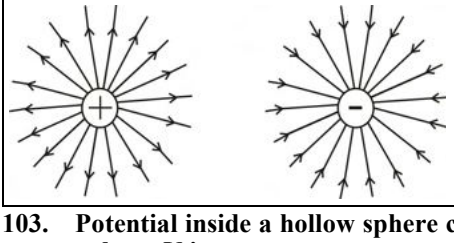
102. A region around a stationary electric charge has_____.

(a) Electric and magnetic field
(b) Electric field
(c) Magnetic field
(d) Gama field

NPCIL (STM) 03.12.2019

Ans. (b) : A region around a stationary electric charge has electric field. The region surrounding the charge experience a stress which applies a attractive or repulsive force on other charge placed in its electric field.

- The force of attraction or repulsion is given by coulombs law which is proportional to product of charge and inversely proportional to the square of distance between them.

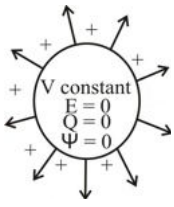


103. Potential inside a hollow sphere charged with a voltage V is

(a) V (b) V/2
(c) 0 (d) 2V

(ISRO DT. 02.06.2019)

Ans : (a) Potential inside a hollow sphere charged with a voltage V is V.



- Potential inside a hollow conductor is constant and hence potential difference is zero.
- Electric field intensity inside the hollow spherical charged conductor is zero.

104. Relative permittivity of vacuum is-

(a) 8.854 (b) 8.854×10^{-12}
(c) Unity (d) Zero

KPSC Electrician -30.09.2020

Ans. (c) : The relative permittivity of vacuum or free space is unity.

- Absolute permittivity $(\varepsilon_0) = 8.854 \times 10^{-12}$ F/m

  Relative permittivity $(\varepsilon_r) = 1$

  $\boxed{\quad {}_0 \; {}_r}$ F/m

The unit of relative permittivity is unit less.

Note: According to commission option (b) is correct

105. The unit of electric field strength is:

(a) Volt/meter (b) Farad/meter
(c) Weber (d) Hertz

RSMSSB Instructor (Wireman) 24.03.2019

Ans. (a) : The unit of electric field strength is volt/meter .

- Electric field strength is also known as electric field intensity .
- It is the force experienced by a unit positive charge at that point .

$$E = \frac{F}{Q} \quad \text{Newton / coulombs}$$

- It is also defined as electric field at an point 's equals to the potential gradient at that point.

$$\boxed{E = \frac{-dv}{dx}} \text{ volt / meter}$$

106. Which of the following components store energy in the form of electrical charges?

(a) Capacitors (b) Transformers
(c) Resistors (d) Inductors

RRB JE 31.08.2019

Ans. (a) : Capacitor : It is a device consisting of two conducting 'plates' separated by an insulating material (dielectric). It stores energy in the form of an electric field with the help of an electric charge.

- The capacitance of a capacitor is measured by equation $C = \frac{q}{\Delta V}$ where q is change and ΔV is a potential difference.
- SI unit of capacitance is farad.
- Energy stored in capacitor $U = \frac{1}{2}CV^2$

107. The colour code of a capacitor is yellow. violet and orange. The value is :

(a) 47000μF (b) 47000pF
(c) 0.47 pF (d) 47pF

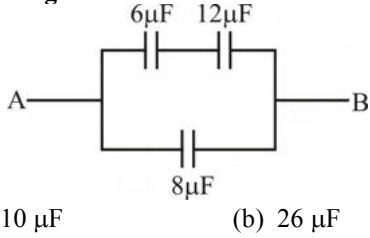
DMRC Electronics 17.02.2017, 8:30 to 10:45 AM

Ans. (b) : The colour code of a capacitor is yellow, violet and orange,

yellow = 4
violet = 7
Orange = 10^3

Thus the value of capacitor = 47×10^3 pF = 47000pF

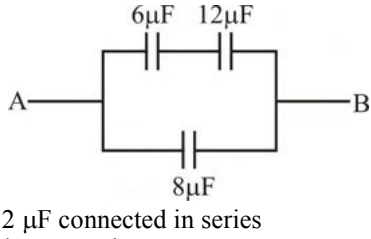
108. What will be the equivalent capacitance of the following circuit?



(a) 10 μF (b) 26 μF
(c) 18 μF (d) 12 μF

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (d) :

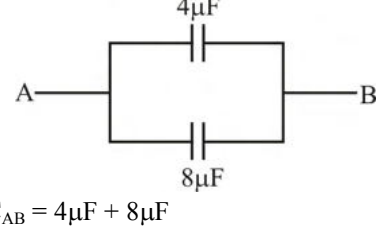


6 μF and 12 μF connected in series
So, Equivalent capacitance -

$$C_{eq} = \frac{6\mu F \times 12\mu F}{6\mu F + 12\mu F}$$

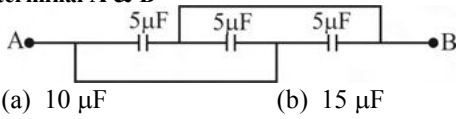
$$= \frac{72\mu F}{18}$$

$$= 4\mu F$$



$C_{AB} = 4\mu F + 8\mu F$
$= 12\mu F$

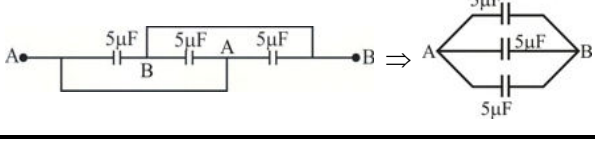
109. Determine the equivalent Capacitance between terminal A & B



(a) 10 μF (b) 15 μF
(c) 7.5 μF (d) 1.67 μF

NMRC Electronics 09.03.2017, 8:30 – 10:45 AM

Ans. (b) :



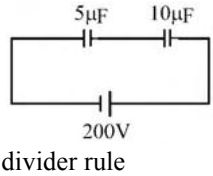
Given capacitance are connected in parallel -
So, equivalent capacitance between terminal A and B-
$C_{eq} = C_1+C_2+C_3$
$C_{eq} = 5+5+5$
$\boxed{C_{eq} = 15\mu F}$

110. If two capacitors having capacitances of 5 μF and 10 μF respectively are connected in series across a 200 V supply, find the potential difference across each capacitor.

(a) 50 V, 100 V (b) 133.33 V, 66.66 V
(c) 200 V, 100 V (d) 100 V, 200 V

DFCCIL EE 11.11.2018, 12:30 PM–2:30 PM

Ans. (b) :

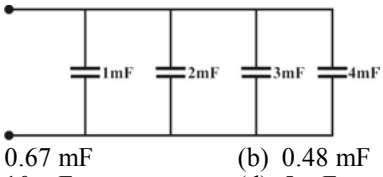


For using voltage divider rule

$$V_{5\mu F} = \frac{V \times 10\mu F}{10\mu F + 5\mu F} = \frac{200 \times 10\mu F}{10\mu F + 5\mu F} = 133.33V$$

$$V_{10\mu F} = \frac{V \times 5\mu F}{10\mu F + 5\mu F} = \frac{200 \times 5\mu F}{15\mu F} = 66.66V$$

111. What will be the resultant capacitance of the given combination?



(a) 0.67 mF (b) 0.48 mF
(c) 10 mF (d) 5 mF

DFCCIL EE 17.04.2016, Shift-II

Ans. (c) : For parallel capacitors
$C_{eq} = C_1 + C_2 +------ + C_n$
$C_{eq} = 1 + 2 + 3 + 4$
$\boxed{C_{eq} = 10 \text{ mF}}$

112. When 2 capacitance C_1 and C_2 are connected in series, the combined capacitance is :

(a) $1/(C_1 + C_2)$ (b) $C_1 + C_2$
(c) $C_1 C_2 / (C_1 + C_2)$ (d) $(C_1 + C_2) / (C_1C_2)$

DMRC Electronics 17.02.2017, 12:00 – 2:15 PM
Delhi Metro Electronic JE-2017

Ans. (c) : Given-
The total capacitance of two capacitor C_1 and C_2 connected in series,

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$\frac{1}{C} = \frac{C_1 + C_2}{C_1C_2}$$

$$\therefore \boxed{C = \frac{C_1C_2}{C_1 + C_2}}$$

113. 2 capacitor of 20μF and 40μF are connected in series across a 90V supply. After charging what will be the charge across each capacitor?

(a) 150μC (b) 100μC
(c) 270μC (d) 1200μC

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM
RRB Bilaspur SSE Yellow Paper-11.12.2014

Ans. (d) : Equivalent capacitance of series connected capacitor -

$$C_{eq} = \frac{C_1.C_2}{C_1 + C_2} = \frac{20 \times 40}{20 + 40} = \frac{800}{60}\mu F$$

$\therefore$ from $q = CV$

$$= \frac{800}{60} \times 90$$

$$\boxed{q = 1200\mu C}$$

114. What is the relationship between current (I) and voltage (V) in a circuit consisting of a capacitor in series with a resistor?

(a) I and V are in phase across the capacitor
(b) I leads V across the resistor
(c) V leads I across the capacitor
(d) I and V are in phase across the resistor

RRB SSE (shift-III), 02.09.2015

Ans : (d) In a pure resistive circuit, the current is in phase with the voltage hence the power factor is unity.

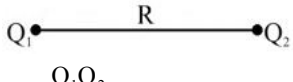
- In a pure capacitive circuit current leads the voltage by 90º. Hence the power factor is zero leading.
- In a circuit consists of a resistor and a capacitor, the current lead the voltage by an angle less than 90º and it is leading.
- Since V = IR across the resistor, and the imaginary part of resistance is zero across a resistor, the voltage and the current will be in phase across the resistor.

115. According to Coulomb's law the force of repulsion existing between two point charges is _____ .

(a) constant
(b) directly proportional to the magnitude of the charges
(c) inversely proportional to the magnitude of the charges
(d) zero

DFCCIL Executive Electrical 20.12.2023, 4:30-6:30 PM

Ans. (b) : According to coulomb's law the force acting between two point charges is directly proportional to the products of charges and inversely proportional to the square of the distance between them.



$$F \propto \frac{Q_1 Q_2}{R^2} \text{ Newton}$$

$$\boxed{F = \frac{1}{4\pi \epsilon_0} \frac{Q_1 Q_2}{R^2}}$$

116. _____ essentially consists of two conducting surfaces separated by a layer of an insulating medium called dielectric.

(a) A capacitor (b) A semiconductor
(c) An inductor (d) A resistor

DFCCIL Executive (EE) -30.09.2021

Ans. (a) : Capacitor :- A capacitor essentially consist of two conducting surfaces separated by a layer of an insulating medium called dielectric.

- Capacitance of parallel plate capacitor.

$$\boxed{C = \frac{A.\varepsilon}{d}} \text{ Farad}$$

Where $\varepsilon = \varepsilon_0 \varepsilon_r$

ε = Permittivity of dielectric (obsolute, not relative)

A = Area of plate in meter square

d = Distance between plates in meters

117. The value of capacitor printed on its body is 104, then it means :

(a) 0.001μF (b) 1 μF

(c) 0.1μF (d) 0.01μF

Delhi Metro Electronic JE 2017, AAI 26.4.2015
RRB Bangalore SSE-01.02.2009

Ans : (c) Given that–

Body code = 104

∴ Third digit (lost digit) = 4

So we have to write 0000 (4 zeros) after first two digit.

So the capacitance value for 104 will be

1000000 picofarads

Or 100 nanofarads

Or 0.1 microfarad.

118. A capacitor having a capacitance of 40 μF is connected across 250 V DC source. The charging current will be least:

(a) initially

(b) when the capacitor is half charged

(c) when the capacitor is 25% charged

(d) when the capacitor is full charged

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM

Ans. (d) : When DC voltage applied across a capacitor. Initially it behaves like a short circuit. After some time voltage of capacitor will became equal to supply DC voltage. Then value of current will become zero and capacitor will behave like open circuit in steady state.

119. What is the SI unit of absolute permittivity of a medium :

(a) $\frac{1}{C}$ (b) $\frac{C^2}{(Nm^2)}$

(c) $\frac{C^2}{(Nm)}$ (d) $\frac{(Nm)}{C^2}$

RRB Gorakhpur Electronic 2014

Ans : (b)

The SI unit of absolute permittivity ε_0 will be $\frac{C^2}{(Nm^2)}$.

$$F = \frac{1}{4\pi\varepsilon_0\varepsilon_r} \cdot \frac{Q_1.Q_2}{d^2}$$

$$\varepsilon_0 \propto \frac{Q_1.Q_2}{Fd^2}$$

$$\varepsilon_0 = \frac{(C)^2}{N.m^2}$$

$$\varepsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$$

08.

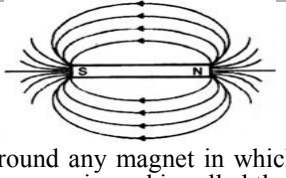
Electrom

Magnetic Force:

The force exerted by one magnet on another magnet for attraction or repulsion is called magnetic force.

- Its S.I. unit is Newton.
- This force has a definite direction at every place and the direction of its effect is according to the direction of the magnetic force lines.

Magnetic field:-



- The area around any magnet in which the magnetic effect can be experienced is called the magnetic field of the magnet.
- At any point in this field, the direction of a line drawn from the north pole to the south pole of a small freely hanging magnetic needle is called the direction of the magnetic field at that point.

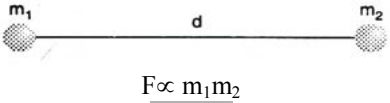
Magnetic lines of force:-

- When a unit north pole is placed in a magnetic field, a force acts on this unit pole, due to this force this pole moves. By drawing imaginary lines on the path it follows to move, this path is obtained in the form of a curve, these curved lines are called magnetic field lines,
- The direction of the magnetic line of force is from the north pole the south pole outside the magnet.
- The direction of the magnetic line of force is from south pole to north pole inside the magnet.
- Magnetic lines of force are in the form of closed curves.
- Magnetic lines of force are like flexible strings are repel each other.
- Two magnetic lines of force never intersect each other.

Coulombs law of magnetic force:-

Coulomb gave the following two laws regarding the magnetic force.

- **First law:-** If the distance between two magnetic pole is kept constant, their mutual attraction or repulsion force is proportional to the product of their pole strengths.
- **Second law:-** The force of attraction or repulsion between two magnetic poles is directly proportional to the product of their pole strengths and inversely proportional to the square of the distance between them.



$$F \propto m_1 m_2$$

$$F \propto \frac{1}{r^2}$$

$$F = \frac{K\, m_1\, m_2}{r^2} \quad \text{or} \quad F = \frac{\mu_0}{4\pi}\frac{m_1 m_2}{r^2}$$

Magnetism and
nagnetic Induction

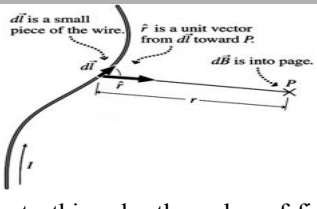
$$\left\{\text{where, } K = \frac{\mu_0}{4\pi} \text{ is a constant and } \mu_0 = 4\pi \times 10^{-7} \text{ H/m}\right\} \mu_r$$

= Relative permeability

for, Air or vacuum $\mu_r = 1$

- The unit of magnetic pole is Weber.

Biot - Savart law:-



According to this rule, the value of field ΔB at any point P in the magnetic field generated by a small element Δl of a current carrying conductor depends on the following factors:

- It is directly proportional to current flowing in the conductor

$$\Delta B \propto i$$

- It is directly proportional to the length of that element of the conductor-

$$\Delta B \propto \Delta l$$

- It is inversely proportional to the square of the distance of point P from the element

$$\Delta B \propto \frac{1}{r^2}$$

Hence, $$\Delta B \propto \frac{i \Delta l \sin\theta}{r^2}$$

- This relation is called Biot savart's law. If the conductor is located in vacuum (or air), then

$$\Delta B = \frac{\mu_0}{4\pi} \frac{i \Delta l \sin\theta}{r^2}$$

Where $\frac{\mu_0}{4\pi}$ is the proportionality constant.

Permeability and permittivity:-

The main difference between permittivity and permeability is that permittivity expresses the objection to the generation of an electric field in a substance, where as permeability expresses the ability to pass the magnetic line of force in a substance.

Relationship between vacuum permeability (μ_0) and vacuum permittivity (ε_0):-

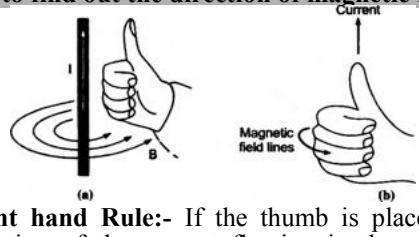
$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$

Where, $c \Rightarrow$ speed of light

$c \Rightarrow 3 \times 10^8$ m/s

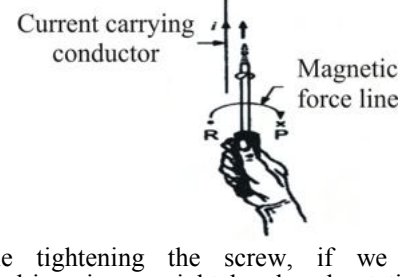
	Permittivity
Definition	Permittivity measures the resistance of by a material to the formation of an el field.
Notation	ε
Formula	The ratio of electric field density to el field strength
SI unit	Farad/meter
Physical	Polarizations
Free space	The permittivity of vacuum is 8.85×10^{-12}
Field	electric field
Used in	Capacitor

Method to find out the direction of magnetic field:–

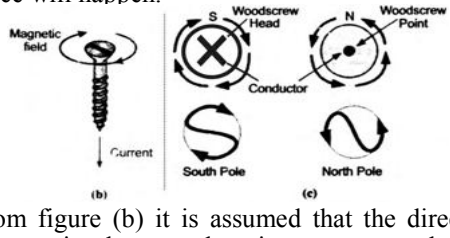


- **Right hand Rule:-** If the thumb is placed in the direction of the current flowing in the conductor, then the bent fingers will show the direction of the magnetic field generated due to the current.
- This is also called thumb's rule.

Maxwell's Right-handed screw Rule:-



- While tightening the screw, if we hold the screwdriver in our right hand and rotation such a way that the tip of the screw moves in the direction of the current flowing in the conductor, then the direction in which the thumb rotates to rotate the screw is the same direction of the magnetic lines of force will happen.



- From figure (b) it is assumed that the direction of current is downwards, since to turn the screw downwards the screw will have to be. rotated clockwise, hence the direction of the magnetic field will be clockwise.

Magnetomotive force (MMF):-

- Magnetomotive force is the magnetic pressure that setup or attempts to setup magnetic lines of force in a magnetic circuit.
- Just as electromotive force (emf) is required for the flow of current in an electric circuit, in the same way magnetomotive force is required to generate magnetic flux in a magnetic circuit.

	Permeability
ffered ectric	Permeability measures the ability of a material to allow magnetic field line to pass through it.
	μ
ectric	The ratio of magnetic field density to magnetic field strength
	Hennery/ meter
	Magnetization
F/m	The permeability of vacuum is $4\pi \times 10^{-7}$ H/m
	magnetic field
	Inductor and transformer core

- The mmf of the magnetic circuit depends on the number of turns in the coils and the current flowing in the coil. If the number of turn in the coil is N and I current is flowing in it then—

$$\boxed{M.M.F = N \times I}$$

- It's unit is ampere turn.

Magnetic field intensity or field strength or magnetizing force:-

- The magnetic field intensity at any point in a magnetic field is equal to the force acting on one Weber north pole (or south pole)
- It is represented by H

$$H = \boxed{\frac{F}{m} = \frac{\mu_0 \mu_r}{4\pi} \frac{m}{d^2}} \text{ Newton/ Weber}$$

- The mmf acting on a unit length of a magnetic circuit is called the intensity of the magnetic field.

For any coil. $\boxed{H = \frac{MMF}{\ell}} \frac{\text{Ampere turn}}{\text{meter}}$

or

$$\boxed{H = \frac{NI}{\ell}}$$

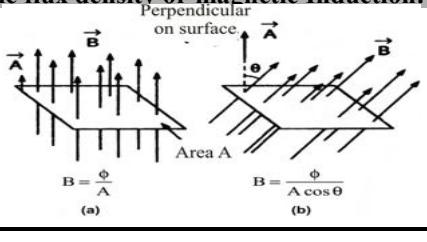
Where, N = number of turns of a coil
I = Value of current flowing through that coil
ℓ = length of magnetic core

- Its unit is ampere per meter or Newton per Weber.
- It is a vector quantity.
- For any coil $\boxed{H \propto i}$

Magnetic flux:-

- Magnetic flux is a property of the magnetic field.
- The sum of all the magnetic line of force in a magnetic field is called magnetic flux. or The total number of magnetic flux lines passing through a given area.
- It is represented by ϕ
- Its S.I unit is Weber,
- It is a scalar quantity

Magnetic flux density or magnetic Induction:-



- The magnetic flux line (ϕ) passing per unit area (A = 1), perpendicular to the direction of a magnetic field, are called magnetic flux density or magnetic Induction.
- It is represented by B.

$$B = \frac{\phi}{A\cos\theta} \text{ Weber/m}^2$$

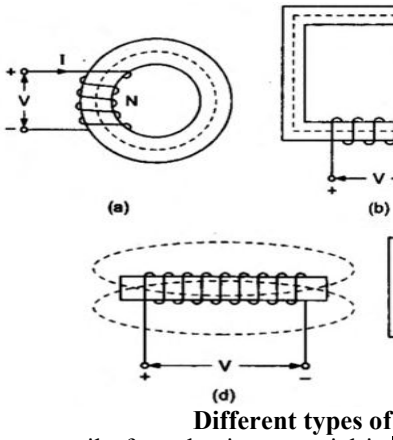
- When the magnetic flux lines are perpendicular to the area then-

$$\theta = 0^\circ \therefore B = \frac{\phi}{A} \text{ Weber/m}^2$$

- The unit of magnetic flux density is–

$$\text{Weber/m}^2 \text{ or Tesla or } \frac{\text{Newton}}{\text{Amp - meter}}$$

- The magnetic flux density is a vector quantity.



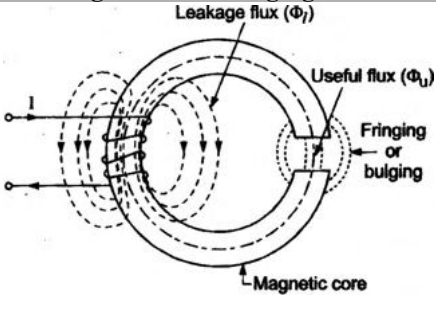
Different types of

- In the shown figure a coil of conducting material is wrapped around a core, has been shown. When current is passed through these coils, flux is setup in this cores. These flux lines are in the form of a close path.

The magnetic flux generated in a magnetic circuit depends on various factors:

- Number of turn of the coil
- Magnitude of the magnetic circuit
- Mean length of the magnetic circuit.
- Core material
- On the area of the core

Magnetic leakage flux and fringing:-



Absolute permeability:-

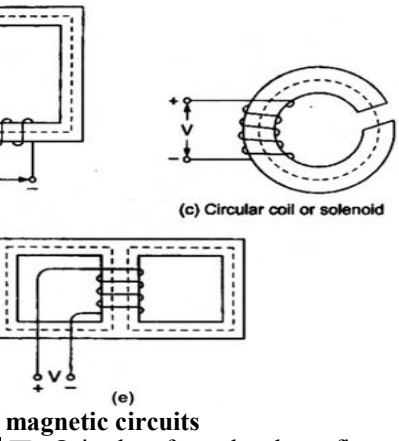
- If in a magnetic material there is a magnetic flux density (B) due to the magnetic field intensity (H), then the ratio of B and H is called the absolute permeability of the material.
- It is also called magnetic permeability.
- It is represented by μ.

$$\boxed{\mu = \frac{B}{H} \quad \text{or} \quad B = \mu H}$$

- Its unit is Henry/meter or Newton/ampere^2

Relative Permeability-

- Relative permeability is a dimensionless quantity.
- The higher the relative permeability of a core, the better the magnetic core material will be, that is, it will generate more flux at less current.
- The close path of magnetic flux is called magnetic path.



(c) Circular coil or solenoid

(e)

magnetic circuits

- It is clear from the above figure that all the flux does not pass through the core, rather same flux gets set-up around the coil, and these fluxes have no useful function in the magnetic circuit. Hence this flux is called leakage flux. It is represented by ϕ_l"
- That parts of the total flux which follows the magnetic circuit is called useful flux. It is represented by 'ϕ_u'

  Hence, Total flux = useful flux + leakage flux

$$\boxed{\phi_T = \phi_u + \phi_l}$$

- The ratio of the total flux generated in the magnetic circuit and the useful flux is called magnetic leakage factor. Which is also called Hopkinson's erosion coefficient. It is represented by 'λ'

Leakage factor $\boxed{\lambda = \frac{\text{Total flux}}{\text{useful flux}} = \frac{\phi_T}{\phi_u}}$

- The value of magnetic leakage coefficient is always greater than1.
- In modern machines or magnetic circuits, the value of magnetic leakage coefficient is kept between 1.12 to 1.26.
- It is clear from the above figure that not all the flux passes through the gap but some flux takes the path outside the gap. That is, the flux which passes through the edges around the air gap is called fringing flux.

- Fringing increases the effective area of the air gap and reduces the flux density of the air gap.
- The fringing effect is greater when the length of the air gap of the magnetic circuit is greater.
- **Keeper circuit:-** Keeper circuit is used to close or complete the magnetic circuit. Its cross section area is similar to the cross section of the magnetic core.
- **Reluctance:-** The obstruction of magnetic flux in a magnetic path is called reluctance. It is represented by 'S'

The reluctance of Magnetic circuit depends on the following things:

- The reluctance of the magnetic path is proportional to the length of the magnetic flux. i.e. $S \propto \ell$ ..... (i)
- On the cross- sectional are of the magnetic path through which the flux passes is inversely proportional to S

$$S \propto \frac{1}{a} \text{ ..... (ii)}$$

- It is inversely proportional to magnetic material permeability-

$$\boxed{S \propto \frac{1}{\mu}} \text{ ..... (iii)}$$

Hence, from equation (i), (ii) and (iii)

$$\boxed{S = \frac{\ell}{\mu_0 \mu_r a} \text{ AT / Weber}}$$

- Its SI unit is AT/Weber (Ampere turn per Weber) or per Henry (H^{-1})
- **Reluctivity or Specific Reluctance:-**
- The reciprocal of the absolute magnetization of a magnetic material is called reluctivity or specific reluctance.

$$\boxed{\text{Reluctivity} = \frac{1}{\mu} = \frac{1}{\mu_0 \mu_r}} \text{ m/H}$$

- It's unit is meter/Henry
- Reluctivity of a magnetic circuit is equal to the resistivity of an electric circuit

Permeance:-

- The opposite of reluctance is called permeance.

$$\boxed{\text{Permeance} = \frac{1}{\text{Reluctance (S)}}} \text{ Henry}$$

- Its unit is Henry or Weber/Ampere turn.
- Permeance of a magnetic material shows how easily the magnetic material is magnetized.
- The permeance of a magnetic circuit is similar to the conductance of an electric circuit.
- For ideal magnetic core material the value of permeance is infinite.

Laws of magnetic circuit:-

- The rules for solving magnetic circuits are similar to the rules for electrical circuit.

  Just as an electrical circuit is solved by applying ohm's law i.e. $I \propto V$ correspondingly,

  $\phi \propto$ mmf can be applied in the magnetic circuit, that is, the flux generated in a magnetic circuit is proportional to the mmf applied on it-

$$\phi \propto \text{mmf}$$

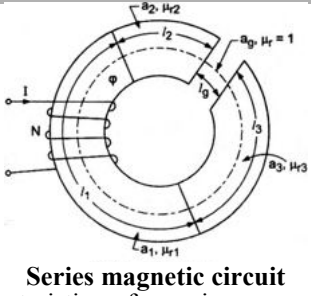
or

$$\boxed{\phi = \frac{\text{mmf}}{S}} \text{ or } \boxed{\text{mmf} = Ni = H\ell = \phi S}$$

$$\because S = \frac{1}{\mu_0 \mu_r a}$$

So, $\boxed{\phi = \frac{Ni}{\ell / \mu_0 u_r a}}$ Weber

Series magnetic circuit:-



Series magnetic circuit

- The characteristics of a series magnetic circuit are similar to those of a series electric circuit
- Just like there are resistances connected in series, in which equal current flows. Similarly, a series magnetic circuit is one whose different part are of different materials dimensions but the magnetic flux in them is the same.
- Total mmf will be equal to the sum of all the mmf.

  Total mmf = $mmf_1 + mmf_2 + mmf_3$ ....

  Hence $\boxed{\phi = \frac{\text{Total mmf}}{\text{Total reluctance}} = \frac{NI}{\text{Total reluctance}}}$

- Since all these parts are in series, their equivalent reluctance can be found by adding them all, like the values of resistances connected in series.

  therefore $\boxed{S = S_1 + S_2 + S_3 + S_4}$

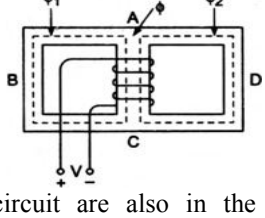
  or

$$\boxed{S = \frac{\ell_1}{a_1 \mu_0 \mu_{r_1}} + \frac{\ell_2}{a_2 \mu_0 \mu_{r_2}} + \frac{\ell_3}{a_3 \mu_0 \mu_{r_3}} + \frac{\ell_4}{a_4 \mu_0 \mu_{r_4}}}$$

Just as V = IR in an electric circuit, similarly in this magnetic circuit-

$$\boxed{\text{mmf} = \phi \times S}$$

Series Parallel magnetic circuit:-



Magnetic circuit are also in the form of series parallel, that is, like in electrical circuits, some branches are in series and some in parallel. similarly, there are series parallel combinations in magnetic circuit also.

in the above circuit-

$$\boxed{\phi = \phi_1 + \phi_2}$$

Total mmf = $mmf_1 + mmf_2$

Total mmf = mmf for length ABC + mmf for length ADC

If S = reluctance of the path AC

S_1 = reluctance of the path ABC

And S_2 = reluctance of the path ADC

then according to Kirchhoff's second law-

$$mmf = \phi_1 S_1 + \phi_2 S_2$$

$$\boxed{\phi S = \phi_1 S_1 + \phi_2 S_2}$$

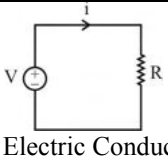
Comparison between Electric and Magnetic circuits:

- **Faraday's law of electromagnetic induction:**
- **Faraday's first laws:-** According to Faraday's first law, when there is a change in the number of lines of force cutting a coil or a conductor circuit an emf is induced in the circuit, due to which the induced current starts flowing in the closed circuit. This current flows for as long as the number of lines of force cutting the circuit changes.
- **Faraday's Second law:-** According to Faraday's second law, the value of the electromotive force induced in a coil or conductor is proportional to the rate of change in the magnetic flux linked to it.

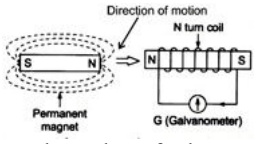
$$e \propto -\frac{d\phi}{dt}, \quad e = -\frac{Nd\phi}{dt}$$

- Here the negative sign indicates that the direction of induced emf opposes the flux change as per Lenz's law.
- Flux changes when frequency changes that is, by increasing the frequency, the rate of flux change increases, due to which the value of induced emf increases.
- The direction of the electromotive force (emf) generated in a coil is determined from Lenz's law and Fleming's right hand rule.
- **Lenz's Law to determine the Direction of Induced emf:** According to Lenz's law, the direction of the electromotive force and the direction

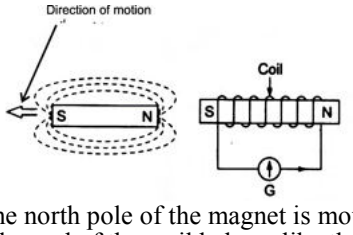
- **Analogy between electric and magnetic circuit**

Electric Circuit	
Voltage/EMF is the 'cause' [Units-volts]	mm
Current is the effect [Unit-Ampere]	Flux
Ohm law $\rightarrow R = \frac{V}{I}\Omega$	Ohm
$R = \frac{\rho \ell}{a}$, Electrical material , ρ = Resistivity (Ω-m)	S =
$E = \frac{V}{d}$, $[\text{volt}/\text{m}]$, E = Electric field intensity	H =
$J = \frac{I}{a} \left[\frac{A}{m^2}\right]$, J = Current density	B =
$J = \sigma E$ J = Electric current density σ = Conductivity (mho/m)	B = μ =
 Electric Conductor (Cu, Al, etc)	 ϕ = Mag

of the current flowing due to that induced electromotive force is always such that it opposes that cause. From which it arises itself. This mean that the induced emf or current tends to destroy the relative motion between the coil and magnet.



- When the north pole of the magnet is moved towards the coil, the nearby end of the coil behaves like the north pole and repel it and prevents it from coming closer.



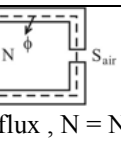
- When the north pole of the magnet is moved away, the nearby end of the coil behave like the south pole and attracts it and prevents it from moving away.

According to Lenz's Law

- Induced emf always opposes the supply voltage.
- Induced current always oppose the supply current.
- The induced flux always oppose the changes in the original supply flux that induced it. Thus, it is clear that Lenz's law is used to find the direction of induced emf in a circuits.
- Hence using Lenz's law, Faraday's second law of electromagnetic induction is expressed with a minus sign attached to it, i.e. the induced emf in a coil due to flux change.

$$e = -\frac{Nd\phi}{dt}$$

Lenz's law is based on the principle of energy conservation.

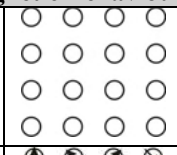
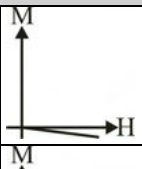
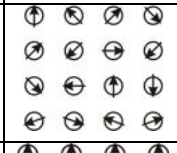
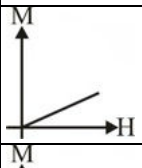
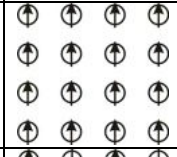
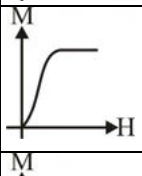
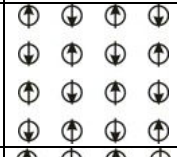
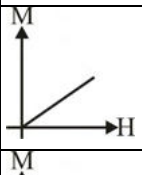
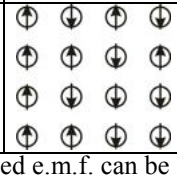
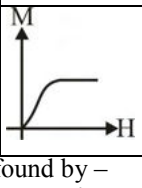
Magnetic Circuit
f→Magneto Motive force is the cause = N.I
k is the effect → [Unit → weber (Wb)]
ns Law- $S = \frac{mmf}{\phi} = \frac{NI}{\phi}$
$\frac{\ell}{\mu a}$, magnetic material μ = Permeability (H/m)
$\frac{mmf}{\ell} = \frac{N.I}{\ell}$, H = Magnetic field intensity
$\frac{\phi}{a}$ $\left[\frac{Wb}{m^2}\right]$ or [Tesla], B = Magnetic field density
μH (B → Mag. Flux density) μ_0 μ_r μ_r = Relative permeability
 flux , N = No. of turns in the coil gnetic Conductor (Fe, Ni, cobalt etc)

❑ Summary of magnetic materials -

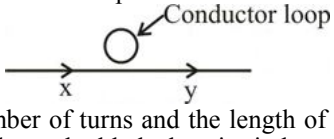
Type	Example
Diamagnetism	Inert gases, many metals - Au, Cu Hg, non-metallic elements - B, Si P, S, many ions - Na^+, Cl^- & thei salts, diatomic molecules - H_2, N_2 H_2O, most organic compounds
Paramagnetism	Some metals - Al, some diatomic gases - O_2, NO, ions of transition metals and rare earth metals, and their salts, rare earth oxides.
Ferromagnetism	Transition metals Fe, Co, Ni alloys of ferromagnetic elements some alloys of Mn - MnBi Cu_2MnAl.
Antiferromagnetism	Transition metals Mn, Cr & many of their compound - MnO, CO NiO, Cr_2O_3, MnS, MnSe, CuC_2.
Ferrimagnetism	(Fe_3O_4-magnetite), (Fe_2O_3- magnemite), mixed oxides of iron and other elements such as S ferrite.

EXAM POINTS

- Fleming's left hand rule is used in– **Motor**
- A standard resistor is made 'bifilar type to eliminate– **Inductive effect**
- A magnet is kept in medium of air surrounded by an iron ring. The magnetic lines of force from the magnet will be– **Crowded in ring**
- According to Faraday's Law of electromagnetic induction an emf is induced in a conductor whenever it– **Cut the magnetic field**
- The negative sign in the expression $e = -N(d\phi)/dt$ is due to– **Lenz's Law**
- "By the motion of the conductor or the coil of magnetic field, i.e. the magnetic field is stationary and the moving conductors cut arrows it. The EMF generated in this way is normally called dynamically induced EMF." The given statement is specified by which law– **Second law of faraday's**
- ..... discovered that a current carrying conductor would move when placed in a magnetic field – **H.C. Oersted or Michael Faraday**
- The self–inductance of a solenoid of N–turns is proportional to – **N^2**
- The direction of the electro–magnetically induced e.m.f is determined by– **Flemings Right hand Rule**
- The induction coil works on the principle of– **Mutual Induction**
- In the magnetic field, in left hand rule, the thumb always represents– **Direction of force on conductor**
- If a conductor is moved in a stationary magnetic field, then emf induced in it. Such an emf is known as – **Dynamically induced emf**

	Atomic/Magnetic Behaviour		
, , r ,	Atoms have no magnetic moment. Susceptibility is small & negative.		
c n d	Atoms have randomly oriented magnetic moments. Susceptibility is small & positive.		
, , ,	Atoms have parallel aligned magnetic moments. Susceptibility is large (below T_C)		
y ,	Atoms have antiparallel aligned magnetic moments. Susceptibility is small & positive,		
- n r	Atoms have mixed parallel and anti-parallel aligned magnetic moments. Susceptibility is large (below T_c)		

- The direction of induced e.m.f. can be found by – **Lenz's law**
- An increasing current in magnitude is flowing from x to y in given figure. The direction of induced current in conductor loop will be – **Clockwise**



- Both the number of turns and the length of the core of a solenoid are doubled, then its inductance will be – **Doubled**
- A coil is said to have a self–inductance of 1 henery if an EMF of 1 volt is induced in it when the current flowing through it changes at the rate of _____ **1 A/sec**
- The direction of magnetic field around a current carrying conductor is found by applying rule– **Right hand thumb rule**
- The basic principle of electromagnetic induction is– **Faraday's laws**
- If the magnetic flux linking a conductor changes, then it induces– **Emf**
- In a magnetic circuit, magneto motive force in an electric circuit…….. is related to – **Electro motive force**
- ..... is a consequence of the law of conservation of energy– **Lenz's law**
- ..... property of an electrical conductor opposes a change in the current– **Inductance**
- In a series combination of several inductors, the equivalent inductance is– **Greater than the largest inductance of the combination**
- Dimension of inductance is – $\mathbf{ML^2T^{-2}A^{-2}}$ **or** $\mathbf{\frac{ML^2}{Q^2}}$

- The law of electromagnetic induction is also called– **Faraday's law**
- If the iron core of a coil is removed so that it becomes a coil with air core, then its inductance **Will decrease.**
- Electromotive force in a circuit– **Maintains potential difference**
- According to Faraday's Law of Electromagnetic Induction, an emf is induced in a conductor whenever it– **Cuts magnetic flux**
- Given volt–amp relationship $\psi = Li$ determines which parameter of circuit elements– **Inductance**
- The electromagnets is made of– **Soft iron core with current passing around it**
- According to Lenz's law, the induced e.m.f sets up a current in which direction– **Direction, opposite of cause producing it**
- According to Fleming's right hand rule the thumb shows– **Direction of motion of conductor**
- Linkage flux per unit current is called– **Inductance**
- The laws of electromagnetic induction (Faraday's and Lenz' laws) are summarized in the following equation– **$e = -N d\phi/dt$**
- "In all cases electromagnetic induction, an induced voltage will cause a current to flow in a closed circuit in such a direction that the magnetic field which is caused by that current will oppose the change that produces the current", is the original statement of– **Lenz's law**
- For a linear electromagnetic circuit, which statement is true– **Field energy is equal to the co–energy**
- If λ is the flux linkage of a coil and I is the current through the coil then inductance of the coil is– **$L = \lambda/I$**
- Which law describe the dynamically induced EMF in a generator– **Faraday's law**
- In Fleming's right hand rule, the middle finger indicates the direction of– **Dynamically induced emf in a conductor**
- The direction of electromagnetically induced current in a circuit placed in a varying magnetic field may be found by– **Fleming's Right Hand Rule or Lenz's law**
- The direction of force on a current carrying conductor placed in a magnetic field can be found by using– **Fleming's left hand rule**
- A solenoid is defined as an electromagnet– **Having more axial length than diameter**
- In Lenz's law the induced emf 'e' opposes the– **Change in flux**
- Faraday's Law is applicable– **In all changing Magnetic field**
- The magnitude of the induced emf in a conductor depends on the– **Rate of change of flux linkages**
- Fleming's left hand rule, Thumb always represent direction of– **Mechanical force**

- According to fleming's left hand rule, the middle finger represent as– **The direction of flow of current in the conductor.**
- Induced e.m.f generated in a coil moving in a magnetic field by which law can the direction of induced emf be known– **Fleming's right hand rule.**
- Consider a constant uniform magnetic field. A conductor moves across this field at a constant velocity. The emf induced in the conductor is termed as– **Dynamically Induced emf**
- When the current through the coil of an electromagnet reverses, the– **Direction of the magnetic field changed**
- If the number of turns of a coil is increased, its inductance– **Is increased**
- According to faraday's law for electromagnetic induction, whenever the magnetic flux associated with the coil change– **An emf is induced in the coil.**
- In the left hand rule, forefinger always represents– **Magnetic field**
- The e.m.f. induced in a coil due to relative motion of a magnet is independent of– **Coil resistance**
- .....is a source of an Electromagnetic field– **An oscillating dipole**
- Maxwell's curl equation for electromagnetic field is given by– $\nabla \times \bar{B} = \mu_0 \left[\bar{J} + \frac{\partial}{\partial t}\left(\varepsilon_0 \bar{E}\right) \right]$
- A coil having number of turns N and area A is rotated in a uniform magnetic field B with an angular velocity ω. The maximum e.m.f. induced in the coil is– **N A B ω**
- A car moves on a plain road. The e.m.f. induced in the axle connecting the two wheels is maximum when it moves– **At pole**
- An electron is travelling horizontally towards east. A magnetic field in vertically downward direction exerts a force on electron along– **South**
- A strong magnetic field is applied on a stationary electron. Then the electron– **Remains stationary**
- If a copper disc is rotated rapidly below a freely suspended magnetic needle, the magnetic needle shall start rotating with a velocity– **Less than that of disc and in the same direction**
- An electron moves with a uniform velocity v and enters a region of uniform magnetic field B. If v and B are parallel to each other, then electron will– **Continue to move in the same direction**
- The strength of an electromagnet is determined by– **Current and number of turns, shape and size, core material**
- When a loop wire is rotate in a 2–pole magnetic field, the direction of induced e.m.f. changes once in every– **1/2 revolution**

- A copper rod of length l is rotated about the end perpendicular to a uniform magnetic field of flux density B with a constant angular velocity ω. The induced e.m.f. between the two ends is– $\frac{1}{2}B\ell^2\omega$
- An electromagnet can be made by– **Passing current through a Solenoid**
- A valid value of coefficient of coupling between two inductors– **0.9**
- ..... to estimate the self–induced EMF in a coil with L as self – inductance and carrying a current i(t) – $e = L\frac{di}{dt}$
- _____ law states that the induced current always develops a flux which ____ the very cause it is due to – **– Lenz, Opposes**
- A metallic ring is attached to the wall of a room. When the north pole of a magnet is brought near the ring, the induced current in the ring is– **Clockwise**
- The induced EMF of a conductor with length which moves a distance dx in the time dt, if the component of distance moved at right angle to the component of distance moved at right angle to the field density B is dx sinθ – $EMF = B\ell\frac{dx}{dt}\sin\theta$ **Volt**
- The co–efficient of coupling between two air core coils depends on– **Mutual inductance and Self inductance of two coils**
- The coefficient of coupling of two coils is proportional to – $\frac{1}{\sqrt{L_1.L_2}}$
- According to which law, the direction of induced emf in the choke of a tube light will be such that it will try to oppose the fall of the current in the circuit– **Lenz's law**
- The …….. is numerically equal to the induced EMF in one coil unit rate of change of current in the other coil – **Coefficient of mutual induction**
- For magnetically isolated coils, the value of coefficient of coupling is– **Zero**
- For magnetically coupled circuits, mutual inductance is always– **Positive**
- The dimensional formula for mutual inductance is– $[ML^2T^{-2}A^{-2}]$
- In mutual induction, what passes between conductors in order to create voltage– **Magnetic flux**
- The classical analogous of a simple lever is– **Mutual inductor**
- "The direction of an induced emf is such that it will always opposes the change that is causing" This law is called as– **Lenzs Law**
- The principle of mutual induction is used in machine– **Transformer.**

- If the co–efficient of coupling between two coil is increased, mutual inductance between the coils is– **Increased**
- When two coils having inductances of inductance M, the coefficient of coupling K is given by–

$$K = \frac{M}{\sqrt{L_1 L_2}}$$

- Mutual inductance between two coils can be decreased by– **Moving the coils apart**
- In the phenomena of mutual induction between two coils are– **Magnetically coupled**
- The mutual inductance between two coils depends upon– **Medium between the coils, separation between the coils**
- The mutual inductance between two coils is zero when fluxes produced by them– **Are at right angles to each other**
- The co–efficient of coupling between the primary and secondary of a practical iron–cored transformer is about– **0.9**
- Magnetic bubbles are used as– **Storage device**
- The commonly used material for shielding or screening magnetism is– **Soft iron**
- The power transmitted in power systems may be described by using the equation where P is the power, E is the electric field intensity. H is magnetic field intensity– **P = E×H**
- The effect of stray magnetic fields on the actuating torque of a portable instrument is maximum when the operating field of the instrument and the stray fields are– **Parallel**
- In a magnetic tape blanks are provided at the– **Start and end of the tape**
- If current I passing through inductive coil L, varies from zero to I in time zero to 't' sec, the energy stored by the inductance is– $\frac{1}{2}LI^2$
- The energy stored in a magnetic field of length ℓ metre and of cross–section area A sq–m is –

$$\frac{1}{2} \times \mu A \frac{N^2}{\ell} \times I^2 \text{ Joule}$$

- Magnetic disk, electric motors, relays use elements magnetic– **Electromagnets**
- The energy stored in a coil with inductance L is determined as – $\frac{1}{2}L\left(\frac{dq}{dt}\right)^2$
- Energy stored by a coil is doubled when its current is increased by– **41.4%**
- Energy stored in an inductor is in the form of– **Magnetic field**
- A charged particle moves through a magnetic field perpendicular to it. The energy of the particle will– **Remain unchanged**

- The magnetic energy stored in an inductor is ..... current– **Directly proportional to square of**
- The energy required to demagnetise $1m^3$ of soft iron is about– **$10\ J/m^3$**
- If the current flows in an anti–clockwise direction, then the polarity of the nearer pole will be– **North pole**
- The current through an inductance follows– **An exponential growth**
- Inductance affects the direct current flows– **At the time of turning on and off**
- A coil with a certain number of turns has a specified time constant. If the number of turns is doubled, its time constant would– **Become double**
- The rate of rise of current through an inductive coil is maximum– **At 63.2% of its maximum steady value**
- When both the inductance and resistance of a coil are doubled the value of– **Time constant remains unchanged**
- Magnetic moment is a– **Vector quantity**
- A short circuited rectangular coil falls under gravity with the coil remaining in a vertical plane and cutting perpendicular horizontal magnetic lines of force. it's acceleration will be– **Constant**
- If 'l' is the the length of a conductor lying within the magnetic field and I is the ampere current carried by it, then magnitude of the force experienced by it is – **$F = BI\ell\sin\theta$**
- To induce maximum E.M.F. in a conductor, the direction of motion of the conductor must be– **Perpendicular to the magnetic lines of flux**
- The direction of the magnetic field around the current carrying conductor can be determined by – **Right hand thumb rule**
- The magnetic flux around a straight current carrying wire– **Is strongest near the wire.**
- The force experienced by a current carrying conductor lying parallel to a magnetic field is- **Zero**
- The magnitude of force acting on a current carrying conductor placed in a magnetic field is independent of– **Cross–sectional area of conductor**
- A magnetic needle is kept in a uniform magnetic field. It experiences– **A torque but not a force**
- Direction of induced e.m.f. can be found by– **Lenz's law, Fleming's Right hand rule.**
- A magnetic field exists around– **Moving charges**
- The magneto motive force experienced by a unit N–pole at any point in a circle of 'r' meters away– **$NI/2\pi r$ oersted**
- According to Ampere's law, the relationship of the force between two parallel conductors, carrying a average voltage of the wave current of I_1 and I_2 and displaced with a distance of r for a section of length ℓ, is given by– $$F = \frac{\mu}{2\pi}\frac{I_1 I_2 \ell}{r}$$
- Two parallel conductor carrying current in opposite directions will exert on each other– **A repulsive force**
- The field at any point on the axis of a current carrying coil will be– **Parallel to the axis**
- law states that,"line Integral of the magnetic field intensity H around a closed path is equal to the total current linked by the contour– **Ampere's circuit law**

- A current flows in a conductor from east to west. The direction of magnetic fields at a point above the conductor is– **Toward north**
- When a current carrying conductor is placed perpendicular to a magnetic field, it tends to move– **Perpendicular to the field as well as itself**
- A conductor of length (L) in which (I)ampere current is flowing, B magnetic density and H magnetic intensity is parallel to the field, the force on the conductor will be. **Zero.**
- The field at any point on the axis of a current carrying circular coil will be– **Perpendicular to the axis**
- Two current carrying conductors lying parallel to each other are exerting a force of attraction on each other. The currents are– **In the same direction**
- The force between two current carrying conductors is– **Inversely proportional to the distance between them**
- A solenoid coil must have– **Length greater than breadth**
- When the direction of current in a solenoid coil is anti-clockwise the polarity at the near end will be– **North**
- The Biot–savart's law is a general modification of– **Ampere's law**
- The most effective and quickest way of making a magnet from soft iron is by– **Placing it inside a coil carrying current**
- A current carrying coil is subjected to a uniform magnetic field. The coil will orient so that its plane becomes– **Parallel to the magnetic field**
- When a charged particle moves through a magnetic field, it suffers a change in– **Direction**
- A current is passed through a straight wire. The magnetic field established around it has magnetic lines of force– **Oval in shape and endless**
- A charged particle enters a magnetic field perpendicular to the magnetic lines of force. The path of the particle is– **Circular**
- If an electron enters a uniform magnetic field obliquely, the path of the electron will become– **A spiral**
- The initial permeability of an iron rod is– **The permeability almost in non magnetised state**
- ..... the magnetic compass needle behave in a magnetic field– **It assures a position which follows a line of magnetic flux**
- The stray line of magnetic flux is defined as– **A line of magnetic flux which does not follow the designed path**
- A magnetic field is produced by– **Current–carrying conductor, moving charge, changing electric field**
- Magnetic flux can always be attributed to– **Motion of charged particles**
- Lines of magnetic flux are said to originate– **At a north magnetic pole**.
- An air– cored coil carries steady current. If air–core is replaced by as ferromagnetic material, the flux density in the core will– **Increase**

PREVIOUS YEA

1. The unit of reluctance is :

(a) ampere/cm^2
(b) Weber/cm^2
(c) ampere turns/Weber
(d) ampere turns/cm^2

UPPCL (TG-2) 17.11.2023, Shift-II
KPSC Lineman Exam 19.12.2021
UPPCL TG-2, 19.03.2021 Shift II
KPSC Electrician -30.09.2020
UKSSSC Electrician Instructor 16.06.2019
HSSC Wireman Instructor 17.012.2019
KPSC Lineman 7.02.2018
Kerala PSC Wireman instructor 26.02.2016
ISRO Technician Electrical 27.11.2016
ISRO (URSC) Technician (B) 27.11.2016

Ans : (c) The unit of reluctance is ampere turn/ weber.

■ Reluctance is reciprocal of permeance.

■ Reluctance is the property of magnetic material by the virtue of which it opposes the flow of magnetic flux.

$$\text{Reluctance (S)} = \frac{1}{\mu_0\mu_r}.\frac{\ell}{a} \text{ Henry}^{-1}$$

$$\text{or, } \boxed{S = \frac{NI}{\phi}} \frac{AT}{Wb}$$

Parameter	Unit
Magnetic flux density	Webber/m^2 or Tesla
Magnetic flux intensity	Amp-turn/meter
Magnetic flux	Weber
Reluctance	Henary^{-1}

2. What is the unit of magneto motive force (MMF)?

(a) Weber / $Meter^2$
(b) Ampere / Turn
(c) Ampere Turns
(d) Tesla

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Gujrat Electrical Instructor 01.01.2022
UPRVUNL TG-2, 17.07.2021 Shift I
PGCIL Technician 14.11.2018
MP Line Attendant 23.07.2018
UKSSSC Tech. Electrical Instructor 21.11.2017
MPPKVVCL Line Attendant 26.08.2017
KPSC Instructor Wireman 30.8.2016
KPSC Lineman Exam 21.04. 2016
(R.R.B. Jammu-Shrinagar (L.P.)-2006)

Ans (c) : The unit of magneto motive force (MMF) is ampere turns.

mmf = NI Ampere-turns

■ The unit of magnetic flux density is Tesla or Weber per meter square.

3. Which is used for finding the force direction on a current carrying conductor in magnetic field?

(a) Lenz's law
(b) Fleming's left-hand rule

AR QUESTIONS

(c) Fleming's Right-hand rule
(d) Faraday's second law

UPPCL (TG-2) 17.11.2023, Shift-I
KPSC Lineman-19.12.2021
UPPCL TG-2, 28.03.2021 Shift I
UPPCL TG-2 (Date : 25-01-2019) Shift-II
KPSC Lineman 07.02.2018
KPSC Lineman Exam 21.04. 2016
(UPPCL-TG-2 Electrician-2015)
(UPPCL-TG-2 Electrical-2014)
(R.R.B. Gorakhpur (L.P.)-2007)
(R.R.B. Ajmer (L.P.)-2001)

Ans : (b) Fleming's left hand rule is used for finding the force direction on a current carrying conductor in magnetic field.

Fleming's Left hand Rule- If we arrange our thumb, forefinger and middle finger of the left hand perpendicular to each other, then the thumb indicates the direction of the force experienced by the conductor, the forefinger indicates the direction of magnetic field and the middle finger indicates the direction of current.

- Fleming's left hand rule is used in electric motors.
- Fleming right hand rule is used in electric generator.

4. What is the unit of self Inductance?

(a) Ohm (b) Newton
(c) Tesla (d) Henry

UPPCL TG-2, 09.11.2023 Shift I
JSSC Technician-19.09.2023
UKSSSC Electrician Instructor 16.06.2019
ISRO (IPSC) Technician (B) 22.04.2018
UPPCL Technical Grade-II Electrical 11.11.2016
ISRO (SAC) Technician (B) 06.11.2016
R.R.B. Bengaluru (L.P.)-2014
R.R.B. Ranchi (L.P.)-2006

Ans : (d) Unit of self inductance is Henry.

$$\text{Self inductance (L)} = \frac{\mu_0 \mu_r N^2 A}{\ell} \text{ Henry}$$

or $$\boxed{L = \frac{N\phi}{I}}$$

- The unit of magnetic flux is Weber.
- The unit of capacitor is farad.
- The unit of resistance is ohm.

5. The unit of magnetic flux is-

(a) Henry (b) Weber
(c) Ampere-turn/meter (d) Ampere/meter

UPPCL (TG-2) 07.11.2023, Shift-II
MAHATRANSCO Technician-2023
Chandigarh Assistant Lineman-09.04.2023
(CRPF Constable Tradesman Uttar Pradesh Electrician-06.01.2013)

Ans. (b) : The unit of magnetic flux is weber.

$$\phi = \frac{MMF}{S}$$

Where, MMF → Magneto motive force in ampere-turn
S → Reluctance in per Henry

$$MMF = NI$$

Where, N → Number of turn
I → current

$$S = \frac{\ell}{\mu A}$$

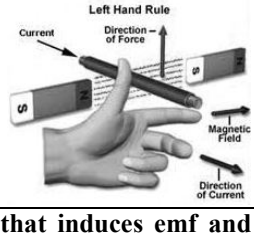
Magnetic quantities	Unit
Absolute permeability (μ_o)	Henry/meter
Magnetic field strength (H)	Ampere/meter or Oersted
Flux density	Wb/m^2 or Tesla
Inductance	Henry

6. Fleming's Left-Hand Rule states that if we arrange our thumb, forefinger, and middle finger of the left hand perpendicular to each other. then the thumb points towards the direction of the

(a) Magnetic force (b) Magnetic flux
(c) Induced current (d) Magnetic field

UPPCL TG-2, 09.11.2023 Shift I
UPRVUNL TG-2 22.12.2022, Shift-II
ISRO (SDSC) Technician (B) 04.06.2022, 4:30-6:30PM
[DMRC Maintainer 10.04.2018, 9.00 -10:30 am]
KPSC Instructor Wireman 30.8.2016

Ans. (a) : Fleming's Left-Hand Rule states that if we arrange our thumb, forefinger and middle finger of the left hand perpendicular to each other. Then the thumb points towards the direction of the magnetic force.



7. The law that induces emf and current always oppose the cause which produces it is discovered by------

(a) Faraday (b) Lenz
(c) Maxwell (d) Leonard
(e) Kirchhoff

UPPCL (TG-2) 10.11.2023, Shift-II
UPPCL (TG-2) 07.11.2023, Shift-I
JVVNL Electrician Helper III, 29.08.2018 Shift I

Ans. (b) : The law that induces emf and current always oppose the cause which produces, it is discovered by Lenz.
■ Lenz law is based on the conservation of energy.

$$e = -N\frac{d\phi}{dt}$$

8. Which law states that the direction of the induced current is such that it opposes the cause which produces it?

(a) Fleming's right hand rule
(b) Faraday's second law

(c) Faraday's first law
(d) Lenz's law

UPPCL (TG-2) 09.11.2023, Shift-II
UPRVUNL (TG-2) 21.12.2022, Shift-II
DSSSB Craft Instructor 10.02.2014

Ans. (d) : Lenz's Law state that the direction of the induced current is such that it opposes the cause which produces it

Lenz's law formula = $e = -N\frac{d\phi}{dt}$

Lenz's law is represented in the formula of faraday law. Hence, the negative sing is contributed by Lenz's law. Where EMF is the induced voltage (also known as electromotive force).

9. The electrical energy consumed by a coil is stored in the form of-
(a) An electrical field
(b) A force field
(c) An electrostatic field
(d) A magnetic field

UPPCL (TG-2) 09.11.2023, Shift-II
KPSC Junior Instructor Electronic Mechanic 20.07.2018

Ans. (d) : The electrical energy consumed by coil is stored in the form of magnetic field.

Stored energy (E_L) = $\frac{1}{2}LI^2$ Joule

■ Electrical energy stored in capacitor in the form of electrostatic field.

Stored energy (E_c) = $\frac{1}{2}CV^2$ Joule.

10. If two coil of self inductance L_1 and L_2 respectively are coupled, then the maximum value of mutual inductance will be equal to——
(a) L_1+L_2
(b) $\sqrt{L_1 \times L_2}$
(c) $L_1 \times L_2$
(d) L_1/L_2

UPPCL (TG-2) 17.11.2023, Shift-I
UPPCL (TG-2) 10.11.2023, Shift-II
UPPCL (TG-2) 03.11.2023, Shift-II
UPPCL TG-2, 20.03.2021 Shift II

Ans. (b) : If two coil of self inductance L_1 and L_2 respectively are coupled, then the maximum value of mutual inductance will be equal to $\sqrt{L_1L_2}$

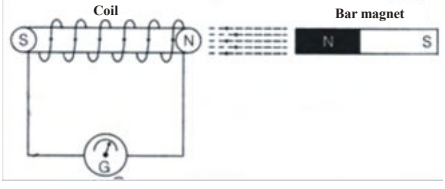
$$M = k\sqrt{L_1L_2}$$

Where,
M = Mutual inductance
k = Coupling coefficient
L_1 & L_2 = self inductance of coil.

11. The direction of statically induced e.m.f can be found with the help of-
(a) Laplace's law
(b) Lenz's law
(c) Lorenz's law
(d) Kirchhoff's current law
(e) Kirchhoff's voltage law

UPPCL (TG-2) 10.11.2023, Shift-II
JVVNL Electrician Helper III, 23.08.2018 Shift II

Ans. (b) The direction of statically induced e.m.f can be found with the help of Lenz's law.



Lenz Law

$$e = -\frac{N d\phi}{dt}$$

- According to Lenz's law the direction of induced emf or current in a circuit is such as to oppose the cause that produces it.
- This law used to find the direction of induced emf or induced current.
- This law based an conservation of energy.

12. Lag of magnetic flux density behind the magnetic field strength is known as:

(a) Retentivity (b) Maturity
(c) Hysteresis (d) Coercivity

UPPCL (TG-2) 10.11.2023, Shift-I
UPPCL (TG-2) 17.11.2023, Shift-II
UPRVUNL TG-2 22.12.2022, Shift-II

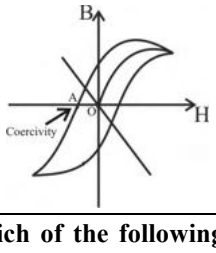
Ans. (c) : Lag of magnetic flux density behind the magnetic field strength is known as hysteresis.
When a magnetic material is subjected to a cycle of magnetisation (it is magnetised first in one direction and then in the other) it is found that flux density 'B' in the material lags behind the applied magnetising force 'H'. this phenomenon is known as hysteresis.

13. The magnetic field required to reduce the residual magnetization to zero is called-

(a) retentivity (b coercivity
(c) hysteresis (d) saturation magnetism

UPPCL (TG-2) 08.11.2023, Shift-I
GSSSB Supervisor Instructor 15.09.2019

Ans. (b) : The magnetic field required to reduce the residual magnetization to zero is called coercivity of the material i.e. its tendency with it holds on to its magnetism.



14. Which of the following law of electromagnetic induction obey the Newton's third law of motion?

(a) Maxwell's corkscrew rule
(b) Flemings right hand rule
(c) Lenz's law
(d) Flemings left hand rule

UPPCL (TG-2) 10.11.2023, Shift-II
UPRVUNL (TG-II) 21.12.2022, Shift-I

Ans. (c) : Lenz's law of electromagnetic induction obeys the Newton's third law of motion.

Lenz's Law- Lenz's law states that the direction of the electric current induced in a conductor by a changing magnetic field is such that the magnetic field created by the induced current opposes changes in the initial magnetic field.

$$\boxed{e = -N\frac{d\phi}{dt}}$$

15. Which of the following instrument is used to determine B-H curves?

(a) B-H meter (b) Wattmeter
(c) Multimeter (d) Fluxmeter

UPPCL (TG-2) 10.11.2023, Shift-II
UPPCL (TG-2) 03.11.2023, Shift-II
UPRVUNL (TG-II) 21.12.2022, Shift-I

Ans. (d) : Flux meter is used to determine B-H curve.
■ Study of magnetic measurement such as flux, flux density, B-H curve, hysteresis loop and magnetizing force is done by following test.
(i) DC test or ballistic tests
(ii) AC test - generally conducted at high frequency
(iii) steady state test - to measure air gap flux.

16. Two 300μH coil in series without mutual coupling have a total inductance of.

(a) 600 μH (b) 300 μH
(c) 150 μH (d) 75 μH
(e) 30 μH

UPPCL (TG-2) 09.11.2023, Shift-I
JVVNL Electrician Helper III, 23.08.2018 Shift II

Ans. (a) Given that,

$L_1 = 300\mu H$

$L_2 = 300\mu H$

$\boxed{\text{total inductance}(L_T) = L_1 + L_2}$

$L_T = 300\ \mu H + 300\mu H$

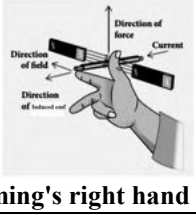
$\boxed{L_T = 600\mu H}$

17. As per Fleming's right hand rule, the fore finger, the thumb and the middle of the right hand are mutually at right angle to each other then, what the forefinger indicates?

(a) Direction of mmf
(b) Direction of the motion of the conductor
(c) Direction of induced current
(d) Direction of magnetic field

UPPCL (TG-2) 03.11.2023, Shift-I
UPPCL (TG-2) 09.11.2023, Shift-I
UPRVUNL (TG-II) 21.12.2022, Shift-I

Ans. (d) : Fleming right hand rule states that if we arrange our thumb, fore finger and middle finger of the right hand perpendicular to each other, then the thumb indicates the direction of the magnetic force, the forefinger indicates the direction of the magnetic field and the middle finger indicates the direction of induced emf.



Fleming's right hand rule

18. The phenomenon where by an EMF and current (i.e. flow of electrons) is induced in any conductor which is cut across or it cut by a magnetic flux is known as:

(a) electrostatic conductance
(b) electromagnetic induction
(c) magnetic field strength
(d) magnetic susceptibility

UPPCL (TG-2) 09.11.2023, Shift-I
CPRI Technician Grade- I, 31.07.2023
UPRVUNL TG-2, 15.07.2021 Shift II

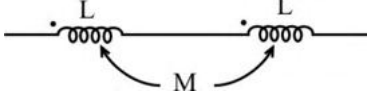
Ans (b) : The phenomenon where by an EMF and current is induced in any conductor which is cut across or it cut by a magnetic flux is known as electromagnetic induction.

19. Two coil of inductance L and mutual inductance M are connected in series. What is equivalent inductance will be?

(a) 2 (L + M)
(b) 2 (L – M)
(c) 2L + M
(d) 2L – M

UPPCL TG-2, 07.11.2023 Shift I
UPPCL TG-2, 20.03.2021 Shift I

Ans. (a) : Given that–
Inductance (L_1) = L
Inductance (L_2) = L
Mutual inductance (M) = M



Formula–

$L_{eq} = L_1 + L_2 + 2M$
$L_{eq} = L + L + 2M$
$L_{eq} = 2L + 2M$
$L_{eq} = 2(L + M)$

20. What is the property of a magnetic material called, due to which energy is lost when the magnetism is reversed?

(a) Magnetic Hysteresis
(b) Self-induction
(c) Magnetic reluctance
(d) Mutually induced EMF

UPPCL (TG-2) 17.11.2023, Shift-II
UPPCL (TG-2) 07.11.2023, Shift-I
UPRVUNL TG-2, 15.07.2021 Shift II

Ans (a) : The property of a magnetic material, due to which energy is lost when the magnetism is reversed is called magnetic hysteresis.
Hysteresis loss– The consumption of electrical power in the repeated magnetization of a magnetic material such as iron is called Hysteresis loss.

21 Which parameter of magnetism is measured in unit of Tesla?

(a) Magnetic field
(b) Magnetic flux path reluctance
(c) Magnetic flux
(d) Magnetic flux density

UPPCL (TG-2) 17.11.2023, Shift-II
UPPCL (TG-2) 07.11.2023, Shift-II
UPPCL TG-2, 28.03.2021 Shift I

Ans : (d) The magnetic flux density of a magnetism is measured in unit of tesla. It is denoted by symbol 'B'.

$$B = \frac{\phi}{A} \quad \frac{Wb}{m^2} \text{ or Tesla}$$

Magnetic flux density is a vector quantity.

22. Whenever the current is increased, the strength of the magnetic field around a wire will____.

(a) decrease (b) increase
(c) remain the same (d) become zero

WBSETCL Technician-2023
CPRI Technician Grade- I, 31.07.2023,

Ans. (b) : Whenever the current is increased, the strength of the magnetic field around a wire will increase.

■ The strength of magnetic field is always proportional to the magnitude of current flowing. Hence, when the current increase, the magnetic field increases.

23. Unit of inductive reactance is-

(a) Farad (b) Weber
(c) Henry (d) Ohm

UPPCL (TG-2) 08.11.2023, Shift-I
MAHATRANSCO Technician-2023
DSSSB Electric Driver or Electric Mistry- 11.07.2023
UPRVUNL TG-II Electrician–2016

Ans : (d) Unit of inductive reactance is ohm.

Parameters		**Unit**
Capacitance	—	Farad
Magnetic flux	—	Weber
Inductance	—	Henry
Capacitive reactance	—	Ohm

24. Magneto motive force in magnetic circuit is analogous to ..... in electric circuit.

(a) Conductance (b) Current
(c) Emf (d) Resistance

UPPCL (TG-2) 08.11.2023, Shift-II
DSSSB Electric Driver or Electric Mistry- 11.07.2023
Chandigarh Assistant Lineman-09.04.2023
UPRVUNL (TG-2) 21.12.2022, Shift-II

Ans. (c): Magneto motive force in magnetic circuit is analogous to emf in electric circuit.

Analogous between electrical circuit and magnetic circuit-

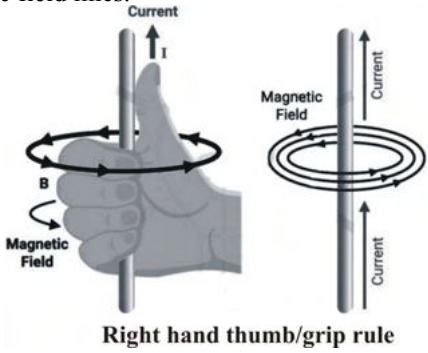
Eclectic circuit	**Magnetic circuit**
EMF	MMF
Resistivity	Reluctivity
Electric field intensity	Magnetic field intensity
Current density	Magnetic field density
Current	Flux
Conductance	Permeance
Conductivity	Permeability
Resistance	Reluctance

25. According to the Right-Hand Grip Rule-

(a) Thumb points to the direction of the magnetic field
(b) Fingers points to the direction of the current flow
(c) Fingers points to the direction of the electric field
(d) Thumb points to the direction of the current flow

UPPCL (TG-2) 10.11.2023, Shift-I
DSSSB Electric Driver or Electric Mistry-11.07.2023
MPESB Electrician 22.12.2022

Ans. (d) : According to the right-hand grip rule thumb points to the direction of the current flow.
Right-hand grip rules also known as right-hand thumb rule.
Right-hand thumb rule- According to the right hand thumb rule, if you are holding a current carrying conductor with the right hand in such a way, that the thumb point in the direction of current then the direction of the wrapped fingers will give the direction of magnetic field lines.



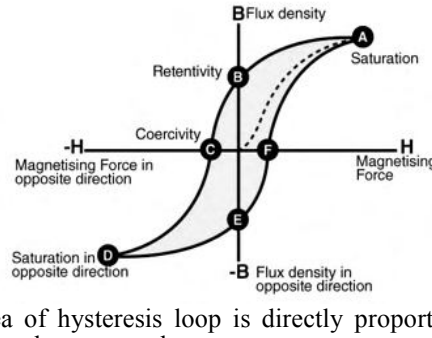
Right hand thumb/grip rule

26. Permanent magnets are normally made of-
(a) Alloy (b) Aluminium
(c) Cast iron (d) Graphite
Chandigarh Assistant Lineman-09.04.2023
KPSC Junior Instructor-19.8.2019

Ans. (a) : Permanent magnets are normally made of alloy like Alnico. A permanent magnet is an object made from material that can be magnetized and creates its own persistent magnetic field.
■ These materials are strongly attracted to magnets.

27. The area of hysteresis loop is a measure of-
(a) Permitivity (b) Permeance
(c) Energy loss per cycle (d) Magnetic force
UPPCL (TG-2) 03.11.2023, Shift-II
UPPCL (TG-2) 09.11.2023, Shift-I
Chandigarh Assistant Lineman-09.04.2023

Ans. (c) : The area of hysteresis loop is a measure of energy loss per cycle.
■ The hysteresis loop represent the relationship between the magnetic flux density and the magnetizing field strength. The loop is generated by measuring the magnetic flux coming out from the ferromagnetic substance while changing the external magnetizing field.



The area of hysteresis loop is directly proportional to the energy loss per cycle.

28. The property of a material which opposes the production of magnetic flux in it is known as-
(a) MMF (b) Reluctance

(c) Permeance (d) Permitivity

UPPCL (TG-2) 09.11.2023, Shift-I
Chandigarh Assistant Lineman-09.04.2023
UPPCL Electrician TG-2 Trainee 16.10.2016 (Re-Exam)

Ans. (b) : The property of a material which opposes the production of magnetic flux in it is known as reluctance.

■ The reluctance is directly proportional to the length of the magnetic circuit and inversely proportional to the area of the cross-section of the magnetic path.

It is a scalar quantity and denoted by symbol 'S'.

$$S = \frac{\ell}{\mu_o \mu_r A}$$

29. A coil of 500 turns is linked with a flux of 1 mWb. If this flux is reversed in 4 ms. What is the average e.m.f. induced in the coil?

(a) – 250 V (b) – 500 V
(c) 500 V (d) 250 V

TSSPDCL Junior Lineman-17.07.2022

Ans. (a) : Given , N = 500 turns

$d\phi = \phi_1 - \phi_2 = 1 - (-1) = 2$ mWb

dt = 4 ms

$$e = -N\frac{d\phi}{dt}$$

$$= -500 \times \frac{2\times10^{-3}}{4\times10^{-3}}$$

$$e = -250V$$

30. Match the following magnetic parameters with electrical paramaers:-

(a)	Reluctivity	**(i)**	Resistance
(b)	Permeance	**(ii)**	Resistivity
(c)	Permeability	**(iii)**	Conductance
(d)	Reluctance	**(iv)**	Conductivity

(a) (a)-(iii); (b)-(iv); (c)-(i); (d)- (ii)
(b) (a)-(ii); (b)-(iii); (c)-(iv); (d)- (i)
(c) (a)-(i); (b)-(iii); (c)-(ii); (d)- (iv)
(d) (a)-(iii), (i); (b)-(iv); (d)- (ii)

TSSPDCL Junior Lineman-17.07.2022

Ans.(b): (a)-(ii); (b)-(iii); (c)-(iv); (d)- (i)

Magnetic Parameter	Electrical Parameter
(a) Reluctivity	**(ii)** Resistivity
(b) Permeance	**(iii)** Conductance
(c) Permeability	**(iv)** Conductivity
(d) Reluctance	**(i)** Resistance

31. The magnetic permeability of a material is defined as-

(a) The ratio of magnetic flux density to magnetizing force
(b) The ratio of magnetizing presence to magnetic flux density
(c) The ratio of magnetizing force to magnetic flux density
(d) The ratio of magnetizing force to magnetic permeability

UPRVUNL (TG-II) 21.12.2022, Shift-I

Ans. (a) : The magnetic permeability of a material is defined as the ratio of magnetic flux density to the magnetizing force.

$$B = \mu H$$

$$\mu = \frac{B}{H}$$

Where, B – Magnetic flux density
H– Magnetizing force
μ– Permeability

Permeability-

- The measure of the ability of a material to support the formation of a magnetic field within itself.
- Measure of the ease in which magnetic flux lines can be established in the material.
- The unit of permeability is Henry/meter (H/m) or Newton's /(ampere)^2.

32. Co-efficient of self-inductance depends upon its-

(a) Rotating magnetic flux
(b) Relative susceptibility
(c) Reflectivity
(d) Relative permeability

UPRVUNL (TG-II) 21.12.2022, Shift-I

Ans. (d) : Co-efficient of self-inductance depends upon relative permeability.

$$L = \frac{N^2 \mu_o \mu_r A}{\ell}$$

Where, μ_r - Relative permeability
A - Area of magnetic material
L - Self inductance
l - length of magnetic material
N- Number of turn in wire
μ_o- Permeability of free space.

33. Why steel is generally difficult to magnetize?

(a) Due to high permeance
(b) Due to low reluctivity
(c) Due to low permeability
(d) Due to high reluctance

UPRVUNL (TG-II) 21.12.2022, Shift-I

Ans. (c) : Steel is generally difficult to magnetize due to low permeability.

Permeability- Permeability is the measure of the ability of the material to allow the formation of magnetic lines of force or magnetic field within.

- Permeability = $\frac{1}{\text{reluctivity}}$
- Permeance = $\frac{1}{\text{reluctance}}$
- Reluctances (S) = $\frac{\ell}{\mu A}$

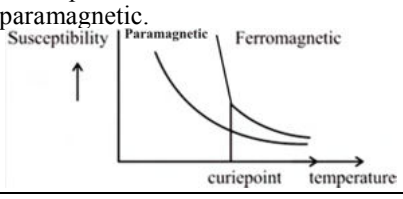
where, ℓ = Length of material
μ = Permeability of material
A = Area.

34. The saturation magnetization of ferromagnets at the curie temperature is-

(a) Maximum
(b) In between maximum and minimum
(c) Zero
(d) Minimum

UPRVUNL (TG-II) 21.12.2022, Shift-I

Ans. (c) : The saturation magnetization of Ferromagnets at the curie temperature becomes zero and above that it becomes paramagnetic.



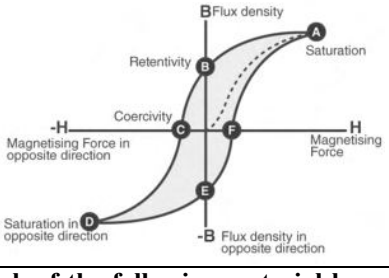
35. The shape of a B-H loop is an indication of the ..... of the material.

(a) Magnetic properties (b) Current density
(c) Resistance (d) Conductivity

UPRVUNL (TG-2) 21.12.2022, Shift-II

Ans. (a) : The shape of a B-H loop is an indication of the magnetic properties of the material.

Magnetic properties – The B-H curve or magnetization curve is the graph plotted between magnetic flux density (B) and magnetizing force (H). The B-H curve indicate the manner in which the magnetic flux density varies with the change in magnetizing force.



36. Which of the following material has maximum value of conductance?

(a) Aluminium (b) Copper
(c) Steel (d) Silver

UPRVUNL (TG-2) 21.12.2022, Shift-II

Ans. (d) : The below table shows the electrical conductivity of different materials –

Metal	Conductivity S/m $\times 10^6$
Silver	6289
Copper	5977
Gold	4255
Aluminium	3766
Iron	1029

■ Silver has the highest electrical conductivity.

■ Silver electrical conductivity is an intrinsic property of a material. If a material allows electric current to pass through it easily, then it is said to have a good electrical conductivity. For example-silver, copper, etc have good electrical conductivity.

37. ..... is the strongest diamagnetic material.

(a) Water (b) Paper
(c) Graphite (d) Bismuth

UPRVUNL (TG-2) 21.12.2022, Shift-II

Ans. (d) : Bismuth is the strongest diamagnetic material.

Diamagnetic substance – Diamagnetic substance are those substances which are repelled by a magnet. Some example of diamagnetic material.

Antimony, bismuth, graphite, copper, lead, gold, silver etc.

- Two of the strongest diamagnetic material are graphite and bismuth, and bismuth is more strongest.

Properties of diamagnetic substances –

- When it is placed in a magnetic field, it develops weak magnetization in a direction opposite to the direction of magnetic field.
- The permeability of a diamagnetic material is slightly less than one.
- The susceptibility of diamagnetic materials is negative.

38. Which of the following is not a paramagnetic material?

(a) Siderite (b) Nontronite
(c) Nickel (d) Pyrite

UPRVUNL TG-2 22.12.2022, Shift-II

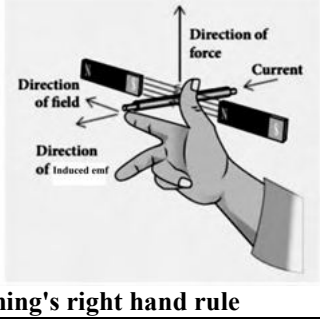
Ans. (c) : Nickel is not a paramagnetic material.
Paramagnetic material- Paramagnetic materials have a small positive susceptibility to magnetic fields. These materials are slightly attracted by magnetic field do not retain the magnetic properties when the external field is remove ex- Aluminium, phosphorous, oxygen.

39. Which rule is to find the direction of induced current when a conductor moves in a magnetic field?

(a) Maxwell's corkscrew rule
(b) Fleming's right-hand rule
(c) Biot-Savart's rule
(d) Fleming's left-hand rule

UPRVUNL TG-2 22.12.2022, Shift-II

Ans. (b) : Fleming right hand rule states that if we arrange our thumb, fore finger and middle finger of the right hand perpendicular to each other, then the thumb indicates the direction of the magnetic force, the forefinger indicates the direction of the magnetic field and the middle finger indicates the direction of induced emf.



Fleming's right hand rule

40. The property of the material that opposes the creation of magnetic flux in a magnetic circuit is:

(a) Permittivity (b) Reluctance
(c) Permeability (d) Permeance

UPRVUNL TG-2 22.12.2022, Shift-II
UPRVUNL (TG-2) 21.12.2022, Shift-II
UPPCL TG-2, 19.03.2021 Shift II

Ans. (b) : The property of the material that opposes the creation of magnetic flux in a magnetic circuit is reluctance.
The unit of reluctances is Ampere-turn/Weber or 1/Henry

$$S = \frac{NI}{\phi} = \text{Ampere - turn/ Weber.}$$

$$\boxed{\text{Reluctance}(S) = \frac{\ell}{\mu_0 \mu_r A}}$$

41. Lenz's law is used to explain how electromagnetic circuits obey the:

(a) Newton's second law (b) Newton's fourth law
(c) Newton's third law (d) Newton's first law

UPRVUNL TG-2 22.12.2022, Shift-II

Ans. (c) : Lenz's law is used to explain how electromagnetic circuits obey the Newton's third law.

Lenz's law : When a voltage is generated by a change in magnetic flux according to Faraday's Law, the polarity of the induced voltage is such that it produces a current whose magnetic field opposes the change which produces it.

$$\boxed{e = -N\frac{d\phi}{dt}}$$

■ Lenz's law is the consequence of the law of conservation of energy.

42. The induced EMF (e) in a conductor as per faraday's 2nd law is:

(a) $e = -N\frac{d\phi}{dt}$ (b) $e = \frac{-d\phi}{dt}$
(c) $e = \frac{d\phi}{dt}$ (d) $e = N\frac{d\phi}{dt}$

UPRVUNL TG-2 22.12.2022, Shift-II
HSSC ALM 14.03.2020 Shift-III

Ans. (a) : The induced EMF (e) in a conductor as per faraday's 2nd law is $\boxed{e = -N\frac{d\phi}{dt}}$

Faraday' second Law : It states the magnitude of the induced E.M.F. equal to the rate of change of flux linkages.

$$\boxed{e = -N\frac{d\phi}{dt}}$$

Faraday's First Law : It states whenever a conductor cuts magnetic flux, an E.M.F. is induced in the conductor.

43. Which of the following exhibit no collective magnetic interactions and are not magnetically ordered?

(a) Ferro-magnetic and Ferri-magnetic
(b) Ferri-magnetic and Anti ferro magnetic
(c) Diamagnetic and Paramagnetic
(d) Paramagnetic and Ferromagnetic

UPRVUNL TG-2 22.12.2022, Shift-II

Ans. (c) : Diamagnetic and paramagnetic exhibit no collective magnetic interactions and are not magnetically ordered.

Diamagnetic Material : Diamagnetic material are those which develop freeble magnetization in the opposite direction of the magnetizing field.

Ex.– Bismuth, Copper, Lead, Zinc etc.

■ Magnetic susceptibility is small and negative.

Paramagnetic material : Paramagnetic material are those which develop freeble magnetization in the direction of the magnetizing field.

Ex.– Aluminium, Chromium, platinum.

■ Magnetic susceptibility is small and positive.

44. Which of the following is true for the hysteresis loop for hard magnets?

(a) The hysteresis loop area is small, retentivity and coercivity is also high
(b) The hysteresis loop area is small, retentivity and coercivity is low
(c) The hysteresis loop area is large, retentivity and coercivity is also high
(d) The hysteresis loop area is small, retentivity and coercivity is low

UPRVUNL TG-2 22.12.2022, Shift-II
DMRC Maintainer 20.02.2020 (9.00-10.30)
DSSSB Instructor Electrician-06.10.2019

Ans. (c) : The material that is use to make for hard magnets should have high retentivity, high coercivity and the hysteresis loop area is large.

■ The hard magnetic material also called permanent magnetic materials.

Ex– Alnico, chromium steel, carbon steel etc.

45. Fleming's left hand rule is used to find

(a) Polarity of magnetic pole
(b) Direction of force on a current carrying conductor in a magnetic field
(c) Direction of magnetic field due to current carrying conductor
(d) Direction of induced emf in solenoid

KPSC Electrician– 07.05.2022

Ans. (b) : Fleming's left hand rule is used to find direction of force on a current carrying conductor in a magnetic field.

■ Fleming's left hand rule is used in motor.
■ Fleming's right hand rule is used in generator.

46. Susceptability is positive for

(a) Ferromagnetic materials
(b) Diamagnetic materials
(c) Paramagnetic materials
(d) None of these

KPSC Electrician– 07.05.2022

Ans. (a) : The susceptability of ferromagnetic materials is high and positive.

■ The susceptability of paramagnetic materials low and positive.
■ The susceptability of diamagnetic materials is low and negative.

47. A magnetic field exists around

(a) Iron (b) Copper
(c) Aluminium (d) Moving charges

KPSC Electrician– 07.05.2022

Ans. (d) : A magnetic field exists around moving charges. The moving charge produces both magnetic field and electric field. The stationary charge produces only electric field.

48. A magnets are made of low retentivity but high permeability materials are called

(a) Permanent magnets (b) Weak magnets
(c) Electromagnets (d) Natural magnets

KPSC Electrician– 07.05.2022

Ans. (c) : A magnets are made of low retentivity but high permeability materials are called electromagnets. Electromagnetic cores should have high permeability so that it supports the formation of a magnetic field within itself. Low retentivity so that magnetic it gets demagnetized easily.

49. The diamagnetic material has a relative permeability is.

(a) Less than 1
(b) More than 1
(c) More than 100
(d) Equal to ferromagnetic material

KPSC Electrician– 07.05.2022

Ans. (a) : The relative permeability of diamagnetic material is less than one.

$\boxed{\mu_r < 1}$

■ The relative permeability of paramagnetic material is slightly greater than one.

$\boxed{\mu_r > 1}$

■ The relative permeability of ferromagnetic material is more greater than one.

$\boxed{\mu_r >>> 1}$

50. Above Neel temperature:

(a) Ferromagnetic material turns paramagnetic.
(b) Paramagnetic material turns Ferro-magnetic.
(c) Anti-ferromagnetic material turns paramagnetic.
(d) Ferromagnetic property is lost in Ferro-magnetic materials.

ISRO TA-03.11.2022

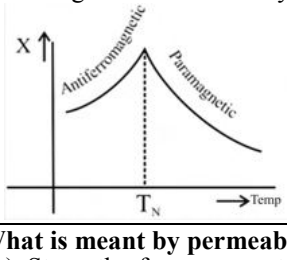
Ans. (c) : Above Neel temperature Anti-ferromagetic material turns paramagnetic.

Neel temperature and above this temperature, these material start behaving like paramagnetic material and their susceptibility becomes maximum.

■ Above Neel temperature, the relationship between magnetization and field intensity is governed by law very similar to curies Weiss law.

$$M = \frac{C.H}{T + T_N}$$

Where C = Curie constant
T_N = Neel temp.
M = Magnetisation
H = Magnetic field intensity



51. What is meant by permeability:

(a) Strength of a permanent magnet
(b) Strength of an electro magnet
(c) The repulsion of two similar poles
(d) The conductivity of a material for the magnetic flux

ISRO TA-03.11.2022
(ISRO Technician Electrical 27.11.2016)

Ans. (d) : Permeability is the conductivity of a material for the magnetic flux.

■ Magnetic permeability is represented by 'μ'.

■ Permeability of free space is also known as permeability of air or vacuum which is represented by μ= B/H.

■ Relative permeability of free space is 1.

52. What is the SI unit for magnetic flux density?

(a) Weber (b) Tesla
(c) Gauss (d) Volt

UPPCL (TG-2) 08.11.2023, Shift-II
ISRO (URSC) Technician (B) 03.11.2022
ISRO (SDSC) Technician (B) 04.06.2022, 4:30-6:30PM
ISRO (SAC) Ahmedabad Technician (B) 18.11.2018

Ans. (b) : SI unit for magnetic flux density– Tesla
or

Magnetic flux density $(B) = \frac{\phi}{A}$

$$\text{unit} = \frac{\text{weber}}{m^2} \text{ or tesla}$$

- Magnetic flux density vector quantity.
- The SI unit of magnetic flux is the– Weber
- Magnetic field intensity unit– A/m or Oersted or N/Wb
- Reluctance SI unit– AT/Wb or per Henry
- Permeance SI unit–Wb/AT
- MMF SI unit–AT or Gilbert
- Permeability SI unit– Henry/meter

53. Which of the following is not required to produce kinetically induced emf?

(a) Magnetic field
(b) Electric field
(c) Conductor
(d) Relative speed between conductor and magnetic field.

CPRI ITI Electrician-19.12.2022, 9:00-10:30AM

Ans. (b) : The electric field is not required to produce kinetically induced emf.

The required to produce kinetically induced emf-

- Magnetic flux
- Conductor
- The relative speed between conductor and magnetic field.

The induced emf is defined as the generation of a potential difference in a coil due to the change in the magnetic flux through it.

54. According to Fleming right hand rule, the fore finger indicates–

(a) Speed of the conductor
(b) Direction of magnetic flux
(c) Direction of current
(d) Direction of voltage

CPRI ITI Electrician-19.12.2022, 9:00-10:30AM

Ans. (b) : According to Fleming right hand rule, the fore finger indicates the direction of magnetic flux.

Fleming's right hand rule -

If we arrange our thumb, forefinger and middle finger of the right hand perpendicular to each other, then the thumb indicates the direction of the motion of the conductor relative to the magnetic field, the forefinger indicates the direction of the magnetic field and the middle finger indicates the direction of the induced emf.

55. The imaginary line joining two pole of a magnet is called------.

(a) Magnetic field (b) Magnetic axis

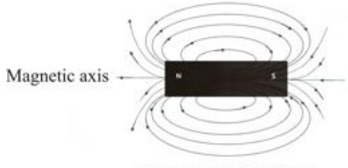
(c) Magnetic line (d) Magnetic neutral axis

CPRI ITI Electrician-19.12.2022, 9:00-10:30AM

UPPCL TG-2, 27.03.2021 Shift I

Ans. (b) : The imaginary line joining the two pole of a magnet is called magnetic axis.

Magnetic axis– The straight line joining the two pole of a magnet (as the magnetic pole of the earth) is known as the magnetic axis.



Magnetic lines of forces

56. Which of the following magnetic material has maximum magnetic permeability (μ)?

(a) Ebonite (b) Aluminium

(c) Steel (d) Copper

TRANSCO JLM-11.02.2018

Ans. (c) : Steel magnetic material has a maximum magnetic permeability (μ).

Magnetic permeability is defined as the ratio of the magnetic flux density to the magnetic field intensity. It is a scalar quantity and it is denoted by symbol 'μ'.

Magnetic permeability (μ) = B/H

Where,

B = Magnetic flux density

H = Magnetic field intensity

The SI unit of magnetic permeability is Henry per meter (H/m) or newton per ampere squared (N/A^2)

57. Water is.....magnetic in nature.

(a) Dia (b) Ferro

(c) Para (d) Ferri

TRANSCO JLM-11.02.2018

Ans. (a) : Water is a diamagnetic in nature. It should not be affected by a magnetic field.

- The relative permeability of a diamagnetic material is less than one.

$$\boxed{\mu_r < 1}$$

- The susceptibility of diamagnetic material is negative and it does not dependent of temperature.

58. The critical temperature above which the Ferro magnetic materials loose their magnetic property is known as.....

(a) Hysteresis

(b) Curie point

(c) Transition temperature

(d) Standard temperature

TRANSCO JLM-11.02.2018

Ans. (b) : The critical temperature above which the Ferromagnetic materials loose their magnetic property is known as Curie point.

Susceptibility $(\chi) = \frac{M}{H}$

Where, M = Magnetization

H = Magnetizing field

59. The law which states that induced e.m.f always opposes the very cause of it, was discovered by.....

(a) Maxwell (b) Faraday
(c) Lenz (d) Fleming

UPPCL TG-2 (Date : 25-01-2019) Shift-I
[DMRC Maintainer 11.04.2018]
TRANSCO JLM-11.02.2018
(DMRC Maintainer Electrician 2017)
(DMRC Maintainer Electrician 2017)

Ans. (c) : The law which states that induced emf always opposes the very cause of it, was discovered by Lenz .
■ It states that the magnitude of emf induced in the coil is equal to the rate of change of flux of that linkages with the coil

$$\boxed{e = -N\frac{d\phi}{dt}}$$

The negative sign represents Lenz's law which states that the flux produced opposes the rate of change of flux.

60. The substances which are weakly attracted by magnets are called.....
(a) Ferromagnetic (b) Diamagnetic
(c) Paramagnetic (d) None of these

IREL Electrician Tradesman-04.09.2022

Ans. (c) : The substances which are weakly attracted by magnets are called paramagnetic substance.
■ The permeability of paramagnetic substance is slightly greater than one.

$$\boxed{\mu_r > 1}$$

■ The susceptibility of paramagnetic substance is slightly greater than one and positive.

61. What is the CGS unit of magnetic flux?
(a) Maxwell (b) Ampere/meter
(c) Tesla (d) Henry
(e) Newton/ampere^2

JVVNL Technical Helper-02.11.2022, 12:00-14:00 PM

Ans. (a) : The CGS unit of magnetic flux is maxwell.
■ The SI unit of magnetic flux is weber.
■ The fundamental unit is volt-second.
■ The flux is usually measured with a flux meter.

62. What is the unit of magnetic field intensity ?
(a) Weber per meter
(b) Volt per meter
(c) Volt per square meter
(d) Ampere per meter

GAIL Technician (Telecom & Telemetry)-21.11.2022, 09:00-10:30AM

Ans. (d) : The unit of magnetic field intensity is ampere per meter.
■ Magnetic field intensity is also called magnetic field strength. It is represented by vector 'H'.

63. Tesla is a unit of-
(a) Field strength (b) Inductance
(c) Magnetic flux density (d) Flux
(e) Capacitance

JVVNL Technical Helper-27.08.2022, 12:00-2:00PM
WBPSC Instructor-18.09.2021
Kerala PSC Wireman Instructor 26.02.2016

Ans. (c) : Tesla is a unit of magnetic flux density (B).

$$B = \frac{\phi}{A}\ Wb/m^2$$

64. What is the unit of permeance?

(a) Ampere-turns
(b) Weber/ampere-turns
(c) Ampere-turns/weber
(d) Weber/m^2
(e) Ampere/m^2

JVVNL Technical Helper-27.08.2022,12:00-2:00PM

Ans. (b) : The unit of permeance Weber/ampere-turns.
■ The S.I. unit of magnetic permeance is henry or weber per ampere-turn.
■ The permeance is an magnetic circuit is reciprocal of the reluctance (S)

65. The reciprocal of permeability is

(a) Reluctivity (b) Susceptibility
(c) Permittivity (d) Conductivity
(e) Resistivity

JVVNL Technical Helper-27.08.2022, 12:00-2:00PM

Ans. (a) : Permeability is the reciprocal of reluctivity. Magnetic permeability is defined as the property of exhibited by the material where the material allows the magnetic line of force to pass through it. The SI unit of magnetic permeability is Henry per meter.

66. Induced electromotive force (EMF) sets up on opposing force on the self generating force is defined by

(a) Faraday's first law
(b) Faraday's second law
(c) Fleming left hand rule
(d) Lenz's law

UPPCL TG-2, 28.03.2021 Shift I

Ans :(d) Induced electromotive force (EMF) sets up an opposing force on the self generating force is defined by Lenz's law

$$EMF = -N\left(\frac{d\phi}{dt}\right)$$

Where,
N = The number of turn.
$d\phi$ = Change in magnetic flux
dt = Change in time.

67. The induced emf is due to the movement of the conductor in a stationary magnetic field is called?

(a) Rotating induced emf
(b) Dynamically induced emf
(c) Optional induced emf
(d) Statically induced emf

UPPCL TG-2, 28.03.2021 Shift I
[DMRC Maintainer 13.04.2018, 9 -10:30 am]

Ans : (b) The induced emf is due to the movement of the conductor in a stationary magnetic field is called dynamically induced emf.
■ When the conductor is in stationary and the field is changing the emf induced in the conductor is called static induced EMF.

68. The interaction between electricity and magnetism is known as.

(a) Permeability (b) Magnet
(c) Reluctance (d) Electromagnetism

UPPCL TG-2, 28.03.2021 Shift I

Ans : (d) The interaction between electricity and magnetism is known as electromagnetism. Electromagnetism is the branch of physics involving the study of electromagnetic forces a type of physical interaction that occurs between electrically charged particles.

69. Which quantity is represented by forefinger in Fleming's left hand rule?

(a) The direction of the field flux
(b) The direction of the electric field
(c) The direction of the current
(d) The direction of force on the conductor

UPPCL TG-2, 28.03.2021 Shift I

Ans : (a) The direction of the field flux is represented by forefinger in Fleming's left hand rule.

Fleming's Left hand Rule- If we arrange our thumb, forefinger and middle finger of the left hand perpendicular to each other, then the thumb indicates the direction of the force experienced by the conductor, the forefinger indicates the direction of magnetic field and the middle finger indicates the direction of current.

70. The shape of the voltage wave-form generated by a coil rotating in a magnetic field is called:-

(a) Tangent wave (b) Sine wave
(c) Cot wave (d) Cosec wave

UPPCL TG-2, 28.03.2021 Shift I

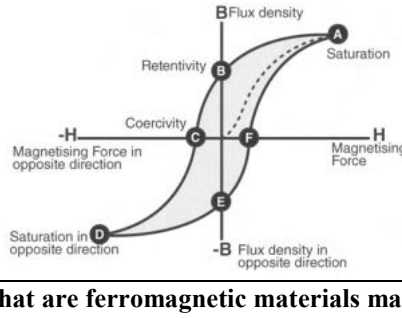
Ans : (b) The shape of the voltage wave form generated by a coil rotating a magnetic field is called sine wave.

71. What does 'B' represented for in hysteresis loop (B-H curve).

(a) Magnetic flux density (b) Reluctance
(c) Magnetizing force (d) Maximum flux

UPPCL TG-2, 28.03.2021 Shift II

Ans (a) : 'B' is represent magnetic flux density in hysteresis loop



72. What are ferromagnetic materials made from?

(a) Graphite, nickel, paper
(b) Iron, aluminium, copper
(c) Iron, nickel cobalt
(d) Bismuth, sulphur, Nickel

UPPCL TG-2, 28.03.2021 Shift II
ALP, Technician 22.01.2019, [12:30-03:00]
UPPCL TG-2 25-01-2019, Shift-II
NMRC Maintainer 07.03.2017, 12.00–02.15 pm

Ans (c) : Ferromagnetic material are Iron, Nickel and Cobalt.

Properties of ferromagnetic material–

- The atoms of ferromagnetic material have permanent dipole moment present in domains.
- The magnetic dipole moment is large and in the direction of the magnetizing field.

■ The relative permeability is also very large and varies linearly with the magnetizing field the field inside the material is much stronger than the magnetizing field. They tend to pull in a large number of line of force by the material.

73. The opposing property of a magnetic circuit for the flow of magnetic flux lines is defined by?

(a) It is defined by magnetic force
(b) The permeability of the magnet
(c) It is equal to the ratio of the magnetic carrying force and the magnetic permeability
(d) It is equal to the ratio of magnetic carrier force to magnetic flux

UPPCL TG-2, 28.03.2021 Shift II

Ans (d) The opposing property of a magnetic circuit for the flow of magnetic flux lines is defined by it is equal to the ratio of magnetic carrier force to magnetic flux.

74. Which one of the given option is not related to the precaution to be taken while storing the magnet?

(a) Store it in a dry place
(b) Store it in a ferromagnetic container
(c) Store in pairs
(d) Use the keeper

UPPCL TG-2, 28.03.2021 Shift II

Ans (b) : Store it in a ferromagnetic container is not related to the precaution to be taken while storing the magnet.

■ The precaution to be taken while storing the magnet caution.

■ It is store in a dry place.

■ It is in pairs.

■ Use the keeper

The keeper is used to close or complete the magnetic circuit. Its cross-sectional area is the same as that of the magnetic core.

75. If a 242 mm long conductor has a force of 0.75N and a current of 640 mA, then the flux density will be approximately.

(a) 4.84 T (b) 9.33 T
(c) 1.67 T (d) 2.32 T

UPPCL TG-2, 19.03.2021 Shift II

Ans : (a) Given than–

Length of conductor (ℓ)=242 mm

$=242\times10^{-3}$ m

Force (F)= 0.75 Newton

Current (I)= 640 mA

$=640\times10^{-3}$ A

Formula–

$$F = IB\ell$$

$$B = \frac{F}{I\ell}$$

$$= \frac{0.75}{640\times10^{-3}\times242\times10^{-3}}$$

$$= \frac{750\times1000}{640\times242}$$

$$\boxed{B = 4.84\,T} \qquad [T = Tesla]$$

76. If a magnet is heated then–

(a) It loses its magnetism
(b) The magnetism neither increases nor loses its loses magnetism
(c) Flux increases
(d) Its magnetization increases

UPPCL TG-2, 19.03.2021 Shift II

Ans : (a) If a magnet is heated then it loses its magnetism.
Curie temperature is the temperature at which certain material loose their permanent magnetic properties, to be replaced by induced magnetism. In other words, it is the temperature above the curie temperature which a ferromagnetic material become paramagnetic material.

Curie temperature of same material–

(i)	Iron	770ºC	or	1043K
(ii)	Nickel	354ºC	or	627K
(iii)	Cobalt	1121ºC	or	1394K

77. In a generator the direction of induced emf is shown by.

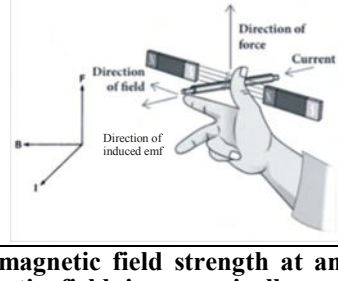
(a) Fleming's right hand rule
(b) Fleming's left hand rule
(c) Faraday's law
(d) Lenz's law

UPPCL TG-2, 19.03.2021 Shift II

Ans : (a) In a generator, the direction of induced emf is shown by Fleming's right hand rule.

Fleming's right hand rule -

If we arrange our thumb, forefinger and middle finger of the right hand perpendicular to each other, then the thumb indicates the direction of the motion of the conductor relative to the magnetic field, the forefinger indicates the direction of the magnetic field and the middle finger indicates the direction of the induced emf.



78. The magnetic field strength at any point in a magnetic field is numerically equal to ------- placed at the point.

(a) N – pole current of one ampere
(b) N – pole voltage of one ampere
(c) N – pole power of one watt
(d) Force on a Weber's N-pole

UPRVUNL TG-2, 14.07.2021 Shift II

Ans. (d) : The magnetic field strength at any point in a magnetic field is numerically equal to force on a Weber's N-pole placed at the point.

$$H = \frac{m}{4\pi\mu_0 r^3} N/Wb$$

Where,

m = pole
r = Distance
H = magnetic field strength

■ Magnetic field strength is a vector quantity.
■ The unit of magnetic field strength is Oersted.

79. The phenomena of magnetism and electromagnetism depend on the specific property of the medium called.

(a) Permeability (b) Dielectric strength
(c) Perfectively (d) Conductance

UPRVUNL TG-2, 14.07.2021 Shift II

Ans. (a) : The phenomena of magnetism and electromagnetism depend on a specific property of the medium is called permeability.

Every medium exhibits two type of permeability.

(i) Absolute permeability (μ_0)

(ii) Relative permeability (μ_r)

$$\boxed{\mu = \mu_0\mu_r}$$

Where μ_0 = permeability of free space

$\mu_0 = 4\pi \times 10^{-7}$ H/m

80. For measuring relative permeability, ... is chosen as the reference medium.

(a) Glass (b) Silver
(c) Vacuum (d) Water

UPRVUNL TG-2, 15.07.2021 Shift I
UPRVUNL TG-2, 14.07.2021 Shift I

Ans (c) : For measuring relative permeability, vacuum is chosen as the reference medium. It is denoted by symbol μ_r.

$$\boxed{\mu_r = \frac{\mu}{\mu_0}}$$

Where, μ = permeability of material

μ_0 = permeability of air or vacuum

81. The magnetic potential is a ..... quantity.

(a) Negative (b) Scalar
(c) Positive (d) Vector

UPRVUNL TG-2, 15.07.2021 Shift I

Ans (b) : The magnetic potential is a scalar quantity. Scalar quantity is a defined as the physical quantity that has only magnitude.

Example– Distance, speed, mass and time etc.

Vector quantity is a defined as the physical quantity that has both magnitude as well as direction.

Example–Force, velocity displacement and acceleration etc.

82. If the total magnetic flux ϕ Wb is passing normally through the area A m^2, then what will be the flux density.

(a) ϕ^2 A Wb^2m^2 (b) ϕ^2 /A Wb^2 /m^2
(c) $\phi \times$A Wb^2 –m^2 (d) ϕ/ A Wb/m^2

UPRVUNL TG-2, 15.07.2021 Shift I

Ans (d) : Magnetic flux density $(B) = \frac{\phi}{A}$

Where, A = area (m^2)

ϕ = flux (Weber)

83. Every medium is supposed to possess two permeability's, that is:

(a) Absolute permittivity and relative permittivity
(b) Standard permeability and relative permeability
(c) Absolute permeability and relative permeability
(d) Master permeability and slave permeability

UPRVUNL TG-2, 15.07.2021 Shift I

Ans (c) : Every medium is supposed to possess two permeability's, that is absolute permeability and relative permeability.

$$\mu = \mu_r \mu_0$$

84. What is the unit of magnetic field strength is-

(a) Newton (b) Weber-Newton
(c) Newton/Weber (d) Newton × Weber

UPRVUNL TG-2, 14.07.2021 Shift I

Ans (c) : The unit of magnetic field strength is Newton per weber

$$H = \frac{F}{m} = \frac{1}{4\pi\mu_0\mu_r}\frac{m}{d^2} \quad \text{Newton / weber}$$

■ It is a vector quantity

85. How to determine the curie temperature of a magnetic material has been defined?

(a) The temperature at which its magnetic strength becomes unity
(b) The temperature at which its magnetic strength becomes infinite
(c) The temperature at which its magnetic strength is zero
(d) The temperature at which its magnetic strength remain the same

UPRVUNL TG-2, 14.07.2021 Shift I

Ans (c) : Curie temperature of a magnetic material is the temperature at which its magnetic strength becomes zero.

■ Curie temperature is a temperature at which magnetic materials change in their magnetic properties. This temperature is called curie point or curie temperature.
■ Above the curie temperature ferromagnetic materials behave like as paramagnetic materials.

86. What is its value in the context of relative permeability of vacuum?

(a) 4 π (b) 1
(c) Infinite (d) 0

UPRVUNL TG-2, 14.07.2021 Shift I
DMRC Maintainer 17.02.2020 (9.00-10.30)
JVVNL Electrician Helper III, 25.08.2018 Shift I

Ans (b) : The value of relative permeability in vacuum is one.

The relative permeability (μ_r) of a substance is the ratio of magnetic permeability (μ) of the substance to the permeability of free space (μ_0).

$$\mu_r = \frac{\mu}{\mu_0}$$

87. If a magnetic material such as soft iron, is placed in a strong magnetic field of a solenoid, it becomes.

(a) Permanent magnet
(b) Magnetising by conduction
(c) Demagnetising by induction
(d) Magnetising by induction

WBSETCL Technician-2023
UPPCL TG-2, 27.03.2021 Shift I

Ans (d) : A magnetic material such as soft iron, is placed in a strong magnetic field of a solenoid, becomes magnetising by induction.

■ A coil of many circular turns of insulated copper wire wrapped closely in the shaped of a cylinder is called a solenoid. One end of the solenoid behaves as a magnetic north pole, while the other behave as the south pole.

■ A strong magnetic field produced inside a solenoid can be used to magnetize a piece of magnetic material likes of iron when placed inside the coil and formed magnet is called an electromagnet.

88. A solenoid has a core of a material with relative permeability 400. The windings of the solenoid are insulated from the core and carry a current 2A. If the number of turns is 1000 per meter. Calculate the magnetic field strength H.

(a) 5×10^{-3}A/m (b) 2×10^{-3}A/m

(c) 5×10^{3}A/m (d) 2×10^{3}A/m

UPRVUNL TG-2, 15.07.2021 Shift II

Ans (d) : Given–

The number of turn (N) = 1000 turn

Length(ℓ) = 1

Carrying current (I) = 2A

Magnetic field strength (H) = ?

Formula $\boxed{H = \frac{NI}{\ell}}$

$$H = \frac{1000\times 2}{1}$$

$$\boxed{H = 2\times 10^{3}\ A/m}$$

89. What is the temperature at which ferromagnetic substance change their state into paramagnetic substance ?

(a) Q – point

(b) Curie temperature

(c) Critical temperature

(d) Violation temperature

UPRVUNL TG-2, 15.07.2021 Shift II

Ans (b): At curie temperature a ferromagnetic substance change their state into paramagnetic substance.

Curie temperature (Tc)- The temperature above which certain materials loose their permanent magnetic properties which can be replace by induced magnetism.

Curie temperature of materials-

Material	**Curie**	**Temperature**
Iron (Fe)	1043 K	770 ºC
Cobalt (Co)	1394 K	1121 ºC
Nickel (Ni)	627 K	354 ºC

90. The temperature at which the vibrations of the molecular alignment so as to reduce the magnetic strength to zero is called.

(a) Avalanche temperature

(b) Curie point

(c) Avalanche break down

(d) Critical break down

UPRVUNL TG-2, 15.07.2021 Shift II

Ans (b) : The temperature at which the vibrations of the molecular alignment so as to reduce the magnetic strength to zero is called curie point.

■ Curie point, also called curie temperature, temperature at which certain magnetic material's under go a sharp change in their magnetic properties. In the case of rocks and minerals, permanent magnetism appears below the curie point about 570 ºC for the common magnetic material magnetite.

91. Which statement is correct according to faraday's first law of electromagnetic induction?

(a) Whenever the magnetic flux is linked with circuit changes, an EMF is always induced in it.
(b) Whenever the electric field is linked with change in circuit, an EMF is always induced it
(c) Whenever the magnetic flux is linked with circuit changes, susceptibility changes proportionally.
(d) Whenever the magnetic flux is linked with circuit changes, a current is always induced in it.

UPRVUNL TG-2, 15.07.2021 Shift II

Ans (a) : Whenever the magnetic flux is linked with circuit changes, an EMF is always induced in it which statement is correct according to faraday's first law of electromagnetic induction.

Faraday's. second law of electromagnetic induction, the induced EMF in a coil is equal to the rate of change of flux linkage.

$$E = -N\frac{d\phi}{dt}$$

92. As magnetic material is heated its magnetic strength will –

(a) Reduce
(b) Increase linearly
(c) Exponentially increase
(d) Remain unaffected

UPRVUNL TG-2, 15.07.2021 Shift II

Ans (a) : As magnetic material is heated its magnetic strength will reduce. All magnetic materials lose their magnetism if heated above curie temperature. The curie temperature is the temperature above that certain material's lose their permanent magnetic properties to be replaced by induced magnetism.

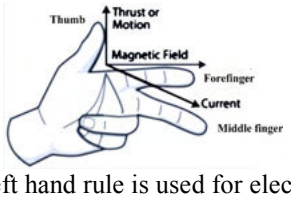
93. According to Fleming left hand rule.

(a) Forefinger direction of current thumb direction of force.
(b) Forefinger direction of force, thumb direction of current.
(c) Forefinger direction of force, thumb magnetic direction.
(d) Forefinger magnetic field, thumb direction of force.

UPPCL TG-2, 20.03.2021 Shift I
(UPPCL-TG-2 Electrical-2014)

Ans (d) :**According to Fleming's Left hand Rule-** If we arrange our thumb, forefinger and middle finger of the left hand perpendicular to each other, then the thumb indicates the direction of the force experienced by the conductor, the forefinger indicates the direction

of magnetic field and the middle finger indicates the direction of current.



- Fleming's left hand rule is used for electric motor.
- Fleming's right hand rule is used for electric generator.

94. A magnetic circuit is required to produce a fixed amount of flux using 500 AT. 60 V has been applied to the exciting coil having 200 turns and a resistance R. The value of R should be:

(a) 8.33 Ω (b) 2.5 Ω
(c) 12 Ω (d) 24 Ω

UPPCL TG-2, 20.03.2021 Shift I

Ans (d) : Given that–

NI = 500 AT N = 200 turn
V = 60 V R = ?
NI = 500 AT

$$I = \frac{500}{200} = \frac{5}{2} A$$

$$I = \frac{V}{R}$$

$$R = \frac{60}{5/2} = 24\Omega$$

$$\boxed{R = 24\Omega}$$

95. Which of the following relations is NOT correct?

(a) $\mu = \frac{H}{B}$ (b) $H = \frac{B}{\mu}$
(c) $\mu = \frac{B}{H}$ (d) $B = \mu H$

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (a) : $\mu = \frac{H}{B}$ relation is not correct.

$$\boxed{\mu = \frac{B}{H}}$$

Where, B = Magnetic flux density (Wb/m^2)
H= Magnetic field strength (N/Wb)

96. Which of the following has the strongest magnetic field?

(a) Wire coil with many loops
(b) Straight length of wire
(c) Wire coil with one loop
(d) Wire coil with many loops around an iron core

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (d) : Wire coil with many loops around an iron core has the strongest magnetic field.

$$H = \frac{NI}{\ell} \quad AT/m$$

Where, NI = mmf
ℓ = Length of magnetic circuit

97. The flux per unit area of a material is known as.....

(a) Flux density
(b) Magneto motive force (MMF)
(c) Reluctance
(d) Magnetic lines of force

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (a) : The flux per unit area of a material is known as magnetic flux density.

$$B = \frac{\phi}{A} \text{Tesla}$$

98. The SI unit of flux density of magnet is-

(a) Weber / meter (b) Lines / cm^2
(c) Tesla (d) Gauss

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (c) : The SI unit of flux density of magnet is tesla or Wb/m^2. $B = \frac{\phi}{(A)}$ Tasla

99. Which of the following is an example of soft magnet?

(a) Alnico (b) Tungsten steel
(c) Cobalt-steel (d) Silicon iron

UPRVUNL TG-2, 17.07.2021 Shift I

Ans (d) : The example of soft magnet is silicon iron. The soft magnetic materials are easy to magnetize and demagnetize. These material used for making temporary magnets. The domain wall movement is easy soft magnetic materials should not possess any void and its structure should be homogeneous so that the material are not affected by impurities. They have low hysteresis loss due to small hysteresis area.
These material are used for electrical machine as transformer and electrical magnet etc.

100. Which of the following are diamagnetic materials?

(a) Aluminium, silver, gold
(b) Bismuth, sulpher, glass
(c) Steel, Nickel, cobalt
(d) Platinum, aluminium, copper

UPPCL TG-2, 27.03.2021 Shift II
KPSC Instructor Electrician 16.09.2020

Ans (b) The diamagnetic material is Bismuth, sulpher glass. The diamagnetic material is weakly magnet. However, the magnetization is in direction opposite to that of the magnetic field. The magnetism that is shown by these material is known as diamagnetism.

Property of Diamagnetic material–

- There are no atomic dipoles in diamagnetic material because the resultant magnetic moment of each atom is zero to paired electrons.
- Magnetic susceptibility is small and negative.
- The relative permeability is slightly less than one.
- Diamagnetic material are independent of temperature.

101. Calculate the inductance of a coil in which a current of 0.2A increases at with rate of 0.4A per second, by giving a power flow of 0.4W.

(a) 5 H (b) 10 H
(c) 4 H (d) 8 H

UPPCL TG-2, 20.03.2021 Shift II

Ans. (a) : Given that,

$$\frac{di}{dt} = 0.4 Amp/sec \quad , \; I = 0.2 \text{ A}$$

$$P = 0.4 \text{ watt}$$

$$U = \frac{1}{2} LI^2$$

$$P = \frac{dU}{dt} = \frac{d}{dt}\left[\frac{1}{2} LI^2\right]$$

$$= \frac{1}{2} \times 2LI \times \frac{di}{dt}$$

$$0.4 = \frac{1}{2} \times 2 \times L \times 0.2 \times 0.4$$

$$\boxed{L = 5H}$$

102. A conductor of length 0.5 m moving with a velocity of 30 m/s in 2T uniform magnetic field density.

(a) 15 V (b) 0 V
(c) 120 V (d) 30 V

UPPCL TG-2, 20.03.2021 Shift II

Ans. (d) : Given that–

v = 30m/s
B = 2T
l = 0.5m
θ = 90º
e = ?

Solution–

e = Blv sin θ
= 2 × 0.5 × 30 × 1 [Sin 90º = 1]
e = 30 volt

103. The reciprocal of reluctance is called.....

(a) Resistance (b) Inductance
(c) Permeance (d) Reluctance

KPSC Lineman-19.12.2021
UPPCL TG-2, 20.03.2021 Shift II

Ans. (c) : The reciprocal of reluctance is called Permeance.

$$\boxed{S = \frac{1}{\mu} \frac{l}{a}},$$

$$\text{Permeance} = \boxed{\frac{1}{S} = \frac{\mu a}{l}}$$

104. Permeance of a magnetic circuit corresponds to the following quantity in electrical circuit.

(a) Inductance (b) Conductance
(c) Specific Resistance (d) Resistance

UPPCL TG-2, 20.03.2021 Shift II

Ans. (b) : The permeance of a magnetic circuit corresponds to the conductance in electrical circuit.

■ The reciprocal of resistance is know as conductance.
■ The reciprocal of resistivity is know as conductivity.

105. The Relative permeability of a material is much greater than one.

(a) Non magnetic (b) Paramagnetic
(c) Diamagnetic (d) Ferromagnetic

UPPCL TG-2, 20.03.2021 Shift II
UPPCL TG-2 (Date : 25-01-2019) Shift-I

Ans. (d) : The Relative permeability of a Ferromagnetic material is much greater than one.

$$\boxed{\mu_r >> 1}$$

- The Relative permeability of a diamagnetic material is less than one.

$$\boxed{\mu_r < 1}$$

- The Relative permeability of a paramagnetic material is slightly greater than one.

$$\boxed{\mu_r > 1}$$

106. A coil is wound uniformly on a steel ring with 300 turns. If the coil resistance is 50 Ω and is connected to a 250 V direct current (DC) supply, then the calculate the mmf.

(a) 2500 AT (b) 3000 AT
(c) 1800 AT (d) 1500 AT

UPPCL TG-2, 20.03.2021 Shift II

Ans. (d) : Given that,

Turn(N)=300 turn
Coil resistance(R)=50Ω
Supply voltage (V)=250 Volt
mmf = ?

$$I = \frac{V}{R} = \frac{250}{50} = 5$$

Magneto motive force (mmf)= NI

$= 300 \times 5 = 1500$ AT

107. The direction of dynamically induced e.m.f. can be determined by–

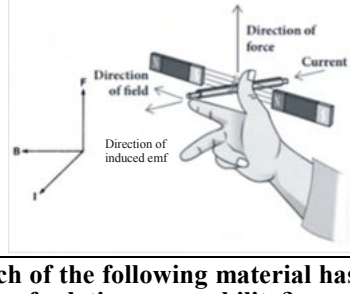
(a) Faraday's law
(b) Fleming's right hand rule
(c) Lenz's law
(d) Kirchhoff's law

UPPCL TG-2, 20.03.2021 Shift II
UPPCL TG-2 (Date : 24-01-2019) Shift-II
UPPCL TG-2 (Date : 25-01-2019) Shift-I
JVVNL Electrician Helper III, 25.08.2018 Shift III
(UPRVUNL-TG-2 Electrical-2015)

Ans. (b) : The direction of dynamically induced e.m.f. can be determine by Fleming's right hand rule.

Fleming's right hand rule -

If we arrange our thumb, forefinger and middle finger of the right hand perpendicular to each other, then the thumb indicates the direction of the motion of the conductor relative to the magnetic field, the forefinger indicates the direction of the magnetic field and the middle finger indicates the direction of the induced emf.



108. Which of the following material has the highest value of relative permeability?

(a) Aluminium (b) Iron
(c) Gold (d) Copper

UPPCL TG-2, 20.03.2021 Shift II

Ans. (b) : The relative permeability of ferromagnetic material such as iron, cobalt and nickel is highest.

$$\boxed{\mu_r >>> 1}$$

- The relative permeability of paramagnetic material is slightly greater than one.

$$\boxed{\mu_r > 1}$$

- The relative permeability of diamagnetic material is less than one.

$$\boxed{\mu_r < 1}$$

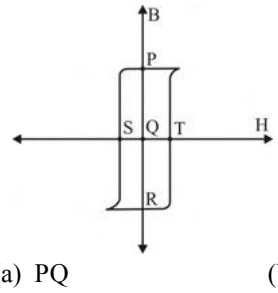
109. Which type of magnetization method is used when the strong magnetic field is required or for multipolar magnetization?

(a) Conventional magnetization method
(b) Static magnetization method
(c) Static electromagnetic field
(d) Positive magnetic field

UPPCL TG-2, 28.03.2021 Shift II

Ans (d) : The positive magnetic field of magnetization method is used when the strong magnetic field is required or for multipolar magnetization.

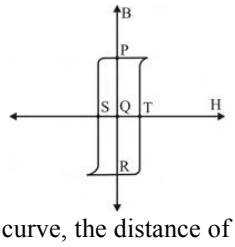
110. In the given B-H curve, the coercive force is distance:



(a) PQ (b) QR
(c) SQ (d) PR

UPPCL TG-2, 20.03.2021 Shift I

Ans. (c) :.



In the given B-H curve, the distance of coercive force is 'SQ'

Properties of soft magnetic material–

- The area of hysteresis loop is less
- The permeability is high
- The magnetic reluctance is less
- The retentivity is less

111. What is the inversely proportional to the permeability ?

(a) Reluctivity (b) Susceptibility
(c) Permittivity (d) Conductance
(e) Reactance

JVVNL Electrician Helper III, 23.08.2018 Shift I

Ans. (a) Reluctivity is the inversely proportional to the permeability.

$$\text{Reluctivity} = \frac{1}{\text{permeability}}$$

- The relation between permeability (μ_0) and permittivity of free space (ε_0) is

$$C = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$$

112. Which of the following is an example of paramagnetic material.

(a) Copper (b) Silver
(c) Gold (d) Tantalum
(e) Cobalt

JVVNL Electrician Helper III, 23.08.2018 Shift I
[DMRC Maintainer 11.04.2018]
(R.R.B. Kolkata (L.P.)-2014)
(R.R.B. Mumbai (L.P.)-2005)

Ans. (d) An example of paramagnetic material is tantalum.

- The relative permeability of paramagnetic material is slightly more than one.

$$\mu_r > 1$$

- The susceptibility of paramagnetic material is small and positive.
- The relative permeability of ferromagnetic material is much greater than one

$$\mu_r >>> 1$$

- The susceptibility of ferromagnetic material is large and positive.
- The relative permeability of diamagnetic material is less than one.

$$\mu_r < 1$$

- The susceptibility of diamagnetic material is small and negative.

113. The property of a material that explains the simplicity that the magnetic flux establishes in part is its–

(a) Corrosivity (b) Retentivity
(c) Permeability (d) Reluctance
(e) Resistance

JVVNL Electrician Helper III, 23.08.2018 Shift I

Ans. (c) The property of a material that explains the simplicity that the magnetic flux establishes in part is permeability.

- The permeability of magnetic circuit is analogy to the conductivity of electrical circuit.
- The SI unit of permeability is Henry per meter.

114. An element whose permeability is less than that of its free space is-------

(a) Ferromagnetic (b) Diamagnetic
(c) Paramagnetic (d) Bipolar
(e) Non-magnetic

JVVNL Electrician Helper III, 23.08.2018 Shift I

Ans. (b) The permeability is less than that of its free space is diamagnetic material.

- The permeability of free space is unity.
- The susceptibility of paramagnetic material is small and positive.

115. Which of the following is ferromagnetic material

(a) Tungsten (b) Aluminium
(c) Copper (d) Nickel
(e) All of these

JVVNL Electrician Helper III, 23.08.2018 Shift II

Ans. (d) The ferromagnetic material is Nickel, cobalt and iron.

- The permeability of ferromagnetic material is greater than one.
- The susceptibility of ferromagnetic material is large and positive.

116. Lenz's law is consequence of the law of conservation of

(a) Current (b) Voltage
(c) Energy (d) Induced
(e) Momentum

JVVNL Electrician Helper III, 23.08.2018 Shift II

Ans. (c) Lenz's law is consequence of the law of conservation of energy.

117. An emf of 16 volts is induced in a coil of inductance 4H. The rate of change of current must be–

(a) 64 A/s (b) 32 A/s
(c) 16 A/s (d) 8 A/s
(e) 4 A/s

JVVNL Electrician Helper III, 23.08.2018 Shift II

Ans. (e) Given that–

e = 16 volt

L = 4H

$$\frac{di}{dt} = ?$$

Formula–

$$\boxed{e = L\frac{di}{dt}}$$

$$16 = 4\frac{di}{dt}$$

$$\frac{di}{dt} = \frac{16}{4}$$

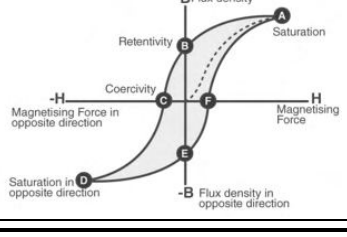
$$\frac{di}{dt} = 4 \ A/s$$

118. Area of hysteresis loop represents.

(a) Total core loss (b) Copper loss
(c) Armature loss (d) Hysteresis loss
(e) Hysteresis loss and eddy current loss

JVVNL Electrician Helper III, 24.08.2018 Shift I
DMRC Maintainer 10.04.2018, 9.00 -10:30 am
DMRC Maintainer 13.04.2018, 9.00 -10:30 am
GSSSB Electronics Instructor 21.01.2014

Ans. (d) : Area of hysteresis loop represent hysteresis loss. The energy loss associated with hysteresis is proportional to the area of the hysteresis loop. As the area of the hysteresis loop for specimen is found to be large, the hysteresis loss in this specimen is also large.



119. What is the basic operating principle of mutual induction?

(a) Transformer (b) Motors
(c) Generator (d) Rectifier
(e) (a), (b) and (c) only

JVVNL Electrician Helper III, 24.08.2018 Shift II

Ans. (e) : The basic operating principle of mutual induction is transformers, motor and generator. Mutual induction occurs when a current flows through one coil or winding and induced a voltage in another coil.

120. Which of the following substance has very high positive susceptibility.

(a) Diamagnetic substance
(b) Ferromagnetic substance
(c) Paramagnetic substance
(d) Anti ferromagnetic substance
(e) Both (c) and (d)

JVVNL Electrician Helper III, 24.08.2018 Shift III

Ans. (b) : Ferromagnetic substance has very high positive susceptibility.

$$\text{Susceptibility } (\chi) = \frac{\text{Intensity of magnetisation (I)}}{\text{magnetising force (H)}}$$

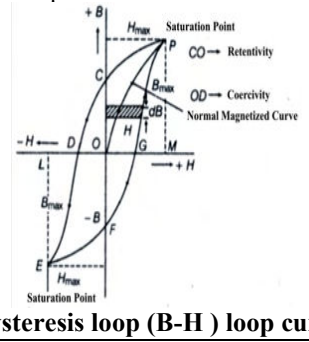
- The susceptibility of paramagnetic material is small and positive.
- The susceptibility of diamagnetic material is small and negative.

121. -------- is uses to show the relationship between the magnetic flux density and the magnetic field strength of a particular material.

(a) Q-V curve (b) B-H curve
(c) V curve (d) SVG curve
(e) P-V curve

JSSC Technician-19.09.2023
JVVNL Electrician Helper III, 25.08.2018 Shift I

Ans. (b) : B-H curve is used to show the relationship between the magnetic flux density and the magnetic field strength of a particular material.



Hysteresis loop (B-H) loop curve

122. How is the value of susceptibility in the case of vacuum is taken.

(a) Zero (b) 0.5
(c) Unit (d) Infinite
(e) 2

JVVNL Electrician Helper III, 25.08.2018 Shift I

Ans. (a) : The value of susceptibility in the case of vacuum is taken zero.

123. What is the reason for the magnetic force in a magnet ?

(a) The speed of rotation of its electrons
(b) Its space rays

(c) Due to the large magnet located inside the earth
(d) Due to the earth
(e) Due to the direction of the magnet

JVVNL Electrician Helper III, 25.08.2018 Shift II

Ans. (a) : The reason for the magnetic force in a magnet is the speed of rotation of its electrons.
In the moving state of particles of electric charge, magnetic force is generated between them.

$$F = qVB.\sin\theta$$

124. The magnetism remaining in a medium when the external magnetic field is removed is called-----

(a) Elastance
(b) Conductance
(c) Remanence
(d) Reluctance
(e) Susceptance

JVVNL Electrician Helper III, 25.08.2018 Shift III

Ans. (c) : The magnetism remaining in a medium when the external magnetic field is removed is called remanence.

125. ..... is the term related to the phenomenon where a change in current through one inductor causes one voltage to be induced across another.

(a) Self inductance
(b) Mutual inductance
(c) Mutual conductance
(d) Capacitance response
(e) All of these

JVVNL Electrician Helper III, 25.08.2018 Shift III

Ans. (b) : Mutual inductance is the term related to the phenomenon where a change in current through one inductor causes one voltage to be induced across another.

Mutual inductance- The ability of one coil to produce an e.m.f. in a near coil by induction when the current in the first coil change. This action being reciprocal, the second coil can also induce an e.m.f. in first when current in the second coil change. This ability of reciprocal induction is measured in terms of the coefficient of mutual induction 'M'.

126. Permanent magnets used in instruments are generally made of.

(a) Cast iron
(b) Steel
(c) Alnico
(d) Y-alloy
(e) Aluminum

JVVNL Electrician Helper III, 25.08.2018 Shift III

Ans. (c) : Permanent magnets used in instruments are generally made of ALNICO.

- Alnico magnets are made of aluminum nickel, cobalt.
- Cast ALNICO magnets are mainly applied in automotive parts, instrument, electro-acoustic, electrical teaching equipment, aviation and military areas, Sintered alnico magnets are widely used in fields of instrumentation, sensors and other.

127. A magnetic pressure that sets up or tends to a flux in a magnetic circuit is called------.

(a) Demagnetization
(b) Cross magnetization
(c) Magnetic field

(d) Electromotive force
(e) Magneto motive force

JVVNL Electrician Helper III, 27.08.2018 Shift I

Ans. (e) : A magnetic pressure that sets up or tends to a flux in a magnetic circuit is called magneto motive force.
Magneto motive force(mmf) = flux(ϕ)×Reluctance(S)
- The force which drives the magnetic flux through a magnetic circuit is known as the magneto motive force (mmf).
- It is analogous to emf in an electric circuit.
- The unit of mmf is ampere-turn (AT).

128. Consider the following substance.
1. Nickel 2. silver 3. oxygen 4. Aluminium
What is the correct order of these substance in the decreasing order of magnetic permeability?
(a) 1,4,3,2 (b) 1,4,2,3
(c) 4,1,3,2 (d) 4,1,2,3
(e) 3,2,1,4

JVVNL Electrician Helper III, 27.08.2018 Shift II

Ans. (a) : Magnetic permeability of substance in decreasing order.
Nickel > Aluminum > Oxygen > Silver
Permeability– Permeability is the ability of a material to allow the magnetic flux when the object is placed inside the magnetic field where magnetic flux is the measure of the number of magnetic lines of force that can pass via a given surface.

129. The emf induced in a conductor by rotating in a magnetic field will be-
(a) Static (b) Dynamic
(c) Both (A) and (B) (d) Negative
(e) Positive

JVVNL Electrician Helper III, 27.08.2018 Shift III

Ans. (b) : The emf induced in a conductor by rotating in a magnetic field will be dynamic.
Fleming's right hand rule -
If we arrange our thumb, forefinger and middle finger of the right hand perpendicular to each other, then the thumb indicates the direction of the motion of the conductor relative to the magnetic field, the forefinger indicates the direction of the magnetic field and the middle finger indicates the direction of the induced emf.

130. The permeability of free space is-
(a) $\mu_0 = 4\pi \times 10^{-7}\,\mathrm{T-m/A}$
(b) $\mu_0 = 4\pi\ \mathrm{T/A}$
(c) $\mu_0 = 4\pi \times 10^{7}\,\mathrm{T^2}$
(d) $\mu_0 = 4\pi\ \mathrm{Tm}$
(e) $\mu_0 = \pi\ \mathrm{Tm/A^2}$

TSSPDCL Junior Lineman-17.07.2022
JVVNL Electrician Helper III, 27.08.2018 Shift III
DSSSB Craft Instructor 10.02.2014

Ans. (a) : The permeability of free space,
$\mu_0 = 4\pi \times 10^{-7}$T-m/A.
- It is a constant of proportionality that exist between magnetic flux density and magnetic field strength of a medium. The permeability constant (μ_0), also known as the magnetic constant or the permeability of free space.

131. How much energy will be stored in a magnetic field coil carrying a self inductance of 5mH and a current of 10 A ?

(a) 0.025 J (b) 0.25 J
(c) 2.5 J (d) 25 J
(e) 250 J

JVVNL Electrician Helper III, 29.08.2018 Shift I

Ans. (b) : Given that,

Inductance(L) = 5 mH
Current(I) = 10A
Energy(U) = ?

$$U = \frac{1}{2}LI^2$$
$$= \frac{1}{2} \times 5 \times 10^2 \times 10^{-3}$$
$$= \frac{1}{2} \times 5 \times 100 \times 10^{-3}$$
$$= 5 \times 50 \times 10^{-3}$$
$$U = 0.25 \text{ joule}$$

132. The unit of magneto motive force in the CGS system is

(a) Gauss (b) Maxwell
(c) Orested (d) Gilbert
(e) Farad

JVVNL Electrician Helper III, 29.08.2018 Shift I

Ans. (d) : The unit of magneto motive force in the CGS system is gilberts.

- The CGS unit of magnetic flux density is gauss.
- The CGS unit of magnetic flux is maxwell.
- The unit of capacitance is farad.

133. Ampere's law use to determine of-

(a) The direction of rotation of the lines of force on the conductor
(b) The polarity of the pole of the electromagnet.
(c) The rotation of the lines of force on the current carrying conductor.
(d) The direction of current in the conductor of the generator
(e) Magnitude of current in the conductor

JVVNL Electrician Helper III, 29.08.2018 Shift I

Ans. (c) : Ampere's law use to determine the rotation of the line of force on the current carrying conductor.

Application of Ampere's law–

- Determine the magnetic induction due to a long current carrying conductor.
- Determine the magnetic field inside a toroid.
- Determine the magnetic field created by a long current carrying conducting cylinder.
- Determine the magnetic field inside the conductor.
- Find force between currents.

134. The self inductance of two coil are 4mH and 9mH respectively. If the coefficient of coupling is 0.5, the mutual inductance between the coil is ------

(a) 12 mH (b) 8 mH
(c) 6.5 mH (d) 3 mH
(e) 2 mH

DMRC Maintainer 20.02.2020 (9.00-10.30)
JVVNL Electrician Helper III, 29.08.2018 Shift I

Ans. (d) : Given that,

Coupling coefficient(K) = 0.5

Self inductance (L_1) = 4 mH

Self inductance (L_2) = 9 mH

Mutual inductance (M)=?

$$M = = K\sqrt{L_1 L_2}$$

$$= 0.5\sqrt{4\times 9} = 0.5\sqrt{36}$$

$$= 0.5 \times 6$$

$$M = 3mH$$

135. Which of the following substance are diamagnetic substance ?

(a) Gold (b) Aluminium
(c) Platinum (d) Iron
(e) Nickel

JVVNL Electrician Helper III, 29.08.2018 Shift II

Ans. (a) : The diamagnetic substance is gold, copper, etc.

Diamagnetic Substance– The substance which are weekly magnetized when placed in an external magnetic field in a direction opposite to the applied field are called diamagnetic substance. The magnetism exhibited by these substance is called diamagnetism.

Example- Gold, copper, antimony, bismuth, silver, lead, silicon, mercury, water, air, etc.

136. One Weber of magnetic flux is equal to magnetic lines of force is

(a) 10^5 (b) 10^6
(c) 10^7 (d) 10^8
(e) 10^9

APSSB Instructor Wireman-19.09.2021
DSSSB Craft Instructor (ESM) 06-10-2019
JVVNL Electrician Helper III, 29.08.2018 Shift I
JVVNL Electrician Helper III, 29.08.2018 Shift II

Ans. (d) : One Weber of magnetic flux is equal to 10^8 magnetic lines of force is.

■ The SI unit of magnetic flux is Weber.

■ The SI unit of magnetic flux density is Tesla.

137. The magnetic potential in a magnetic circuit can be measured in terms is _____.

(a) MMF (b) EMF
(c) Flux (d) Coulomb
(e) Gauss

JVVNL Electrician Helper III, 29.08.2018 Shift II

Ans. (a) : The magnetic potential in a magnetic circuit can be measured in terms is MMF.

Magnetic Circuit	**Electric circuit**
Flux(ϕ) $= \frac{\text{mmf}}{\text{Reluctance(S)}}$	Current(I) $= \frac{\text{emf}}{\text{Resistance(R)}}$
The unit of magnetic flux is weber	The unit of current is ampere
The unit of magnetic flux density is weber/m^2	The unit of current density is ampere/m^2
The unit of reluctance is per Henry	The unit of resistance is ohm
Reluctance(S) $= \frac{\ell}{\mu_o \mu_r a} AT/Wb$	Resistance $(R) = \frac{\rho \ell}{a} \Omega$

138. In a Fleming left hand rule the middle finger represents –

(a) Voltage
(b) Direction of current flowing through the conductor
(c) Magnetic flux
(d) Direction of force
(e) Resistance

JVVNL Electrician Helper III, 29.08.2018 Shift II
(UPPCL Electrician TG-2 Trainee 16.10.2016, Re-Exam)

Ans. (b) : In a Fleming left hand rule the middle finger represents the direction of current flowing through the conductor.

Fleming's Left hand Rule- If we arrange our thumb, forefinger and middle finger of the left hand perpendicular to each other, then the thumb indicates the direction of the force experienced by the conductor, the forefinger indicates the direction of magnetic field and the middle finger indicates the direction of current.

139. What does conductivity correspond to

(a) Reluctance (b) MMF
(c) Permeability (d) Inductance
(e) Capacitance

JVVNL Electrician Helper III, 29.08.2018 Shift III

Ans. (c) The conductivity correspond to permeability.

Magnetic Circuit	**Electric circuit**
1.Flux(ϕ) $= \frac{\text{mmf}}{\text{Reluctance(S)}}$	**1.**Current(I) $= \frac{\text{emf}}{\text{Resistance(R)}}$
2.The unit of magnetic flux is weber	**2.**The unit of current is ampere
3.The unit of magnetic flux density is weber/m^2	**3.**The unit of current density is ampere/m^2
4.The unit of reluctance is per henry	**4.**The unit of resistance is ohm
5.Reluctance(S) $= \frac{\ell}{\mu_o \mu_r a} AT/Wb$	**5.**Resistance $(R) = \frac{\rho \ell}{a} \Omega$
6.Permeance = $\frac{1}{\text{Reluctance}}$	**6.**Conductance = $\frac{1}{\text{Resistance}}$

140. Unit of magnetic permeability is -

(a) Hm (b) H/m
(c) Wb/m (d) Wb/m^2

KPSC Electrician -30.09.2020
DMRC Maintainer 19.02.2020 (9.00-10.30)

Ans. (b) Unit of magnetic permeability is H/m.

- Absolute permeability of free space or vaccum is $4\pi \times 10^{-7}$ H/m.
- Relative permeability of free space or vaccum is one.
- Magnetic permeability is the property of a material that is equal to the magnetic flux density (B) established within the material by magnetizing field divided by the magnetic field strength (H) of the magnetizing field.

$$\mu = \frac{B}{H}$$

unit of B = $\frac{Wb}{m^2}$

Unit of H = $\frac{AT}{m}$ or Newton / Wb

$$\mu = \frac{Wb}{m^2} \div \frac{AT}{m} = \frac{Wb}{m^2} \times \frac{m}{AT}$$

$$= \frac{Wb}{AT \times m} \text{ or henry / meter}$$

wb / Am

Hence, the unit of magnetic permeability is wb/Am. and henry/meter.

141. Magnetising force acting in a magnetic circuit of mean length 1 mm is 400 AT/m. What is the value of the current responsible for this if it flows through a coil of 40 turns.

(a) 1A (b) 100mA
(c) 10mA (d) 10A

DMRC Maintainer 19.02.2020 (9.00-10.30)

Ans. (c) Given that,

Magnetizing force (H) = 400AT/m

Length (ℓ) = 1mm = 10^{-3}m

Turn (N) = 40 turn

Current (I) = ?

$$400 = \frac{40 \times I}{10^{-3}}$$

$$I = \frac{400 \times 10^{-3}}{40}$$

$$\boxed{I = 10mA}$$

142. The voltage drop in an electric circuit corresponds to which parameter of the magnetic circuit?

(a) Permeance (b) Reluctance
(c) Flux (d) MMF

DMRC Maintainer 18.02.2020 (9.00-10.30)

Ans. (d) : The voltage drop in an electric circuit corresponds to MMF of the magnetic circuit.

Magnetic Circuit	Electric circuit
1. Flux(ϕ) $= \frac{mmf}{Reluctance(S)}$	**1.** Current(I) $= \frac{emf}{Resistance(R)}$
2. The unit of magnetic flux is weber	**2.** The unit of current is ampere
3. The unit of magnetic flux density is weber/m^2	**3.** The unit of current density is ampere/m^2
4. The unit of reluctance is per Henry	**4.** The unit of resistance is ohm
5. Reluctance(S) $= \frac{\ell}{\mu_o \mu_r a}$ AT / Wb	**5.** Resistance $(R) = \frac{\rho \ell}{a} \Omega$
6.Permeance = $\frac{1}{Reluctance}$	**6.**Conductance = $\frac{1}{Resistance}$

143. Which of the following magnetic material change with change in permeability?

(a) Resistance (b) Applied voltage
(c) Current (d) Temperature

DMRC Maintainer 18.02.2020 (9.00-10.30)

Ans (d) : Permeability of magnetic material changes with change in temperature.

■ **Curie law-** The magnetic susceptibility of paramagnetic material is inversely proportional to its absolute temperature.

$$\chi \propto \frac{1}{T}$$

$$\chi = \frac{C}{T}$$

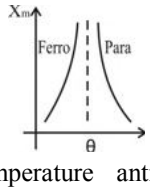
Curie- weiss law-

According to this law $\chi = \frac{C}{T-\theta}$ instead of $\frac{C}{T}$

θ = weiss constant

where, C = Curie constant

T = Absolute temperature



■ At neel temperature anti-ferromagnetic materials become paramagnetic material.

■ At curie temperature ferromagnetic material becomes paramagnetic material.

144. Magnetic flux in a magnetic circuit is produced by-

(a) Impedance (b) Temperature
(c) Voltage (d) MMF

DMRC Maintainer 18.02.2020 (9.00-10.30)

Ans (d) : Magnetic flux in a magnetic circuit is produced by mmf. i.e. the force responsible for setup the magneto motive force.

mmf is the product of number of turn and current

$$\boxed{\text{MMF} = \text{NI Amp.turn}}$$

145. .....The SI unit of flux is.

(a) Weber/cm^2 (b) Ampere turn Weber
(c) Weber (d) Weber/m^2

MPESB Electrician -21.12.2022, Evening
IREL Electrician Tradesman-04.09.2022
UPPCL TG-2, 28.03.2021 Shift I
DMRC Maintainer 17.02.2020 (9.00-10.30)
UKSSSC Electrician Instructor 16.06.2019
UPPCL TG-2 (Date : 24-01-2019) Shift-II
PGCIL Technician 14.11.2018
(DMRC Maintainer Electrician 2017)
GSSSB Instructor Electrical 15.11.2016
(R.R.B. Jammu-Shrinagar (L.P.)-2010)

Ans (c) : The SI unit of flux is Weber.

■ The unit of reluctance is ampere-turn per Weber.

■ The unit of magnetic flux density is Weber / meter^2.

146. 1 Tesla = ___ Weber/m^2

(a) 1 (b) 10
(c) 0.1 (d) 100

HSSC ALM 14.03.2020 Shift-II
RSMSSB Instructor (Electrician) 24.03.2019
UPPCL TG-2 (Date : 25-01-2019) Shift-I
ISRO Ahmedabad Tech 29.04.2018
MP Line Attendant 24.08.2018.
Haryana Shifting Assistant 2016.

Ans. (a) : One Tesla is equal to one Weber/meter^2.

$$\boxed{1 \text{ Tesla} = 1 \text{ Weber/meter}^2}$$

$$\boxed{B = \frac{\phi}{A} \text{Tesla}}$$

Where, ϕ = Magnetic flux
A = Area

147. For diamagnetic materials χ (susceptibility) is-

(a) Neutral (b) Large
(c) Positive (d) Negative

RSMSSB Instructor (Electrician) 24.03.2019

Ans. (d) : For diamagnetic materials χ (susceptibility) is negative.

- For paramagnetic materials χ (susceptibility) is positive.
- For ferromagnetic materials χ (susceptibility) is positive.

148. Hard magnetic materials are used-

(a) In electric traction
(b) For relays
(c) In circuit breakers
(d) For making permanent magnets

RSMSSB Instructor (Wireman) 24.03.2019
GSSSB Instructor Electrical 15.11.2016

Ans. (d) : Hard magnetic materials are used for making permanent magnets.

149. Which of the following is a unit of inductance?

(a) Ampere second/Volt
(b) Volt second/Ampere
(c) Coulomb/(Volt Ampere)
(d) (Volt Ampere)/Coulomb

(ISRO DT. 10.02.2019)

Ans : (b) Unit of inductance is volt second/Ampere
Formula–

$$L = e\frac{dt}{di} \text{ volt-sec/ampere}$$

150. In an inductor, the current changes from 0A to 10A uniformly in 20s time. The induced voltage is 2V. What is the inductance of the inductor?

(a) 1 Henry (b) 2 Henry
(c) 3 Henry (d) 4 Henry

(ISRO DT. 02.06.2019)

Ans : (d) Given that,
Change in current (di) = (10-0) = 10A
Change in time (dt) = 20 sec

$$e = 2V$$
$$L = ?$$

Formula, $$e = \frac{Ldi}{dt}$$

$$L = e\frac{dt}{di} = 2 \times \frac{20}{10} = 4 \text{ Henry.}$$

151. The constituent having highest percentage by weight in Permalloy is

(a) Iron (b) Boron
(c) Cobalt (d) Nickel

(ISRO DT. 02.06.2019)

Ans :(d) Nickel constituent having highest percentage by weight in permalloy.

- Permalloy is a magnetic material having 80% Nickel and 20% iron in content.
- Permalloy is widely used for fabricating the then piece that are laminated to transformer core.

152. Permanent magnets are made up of

(a) Alnico (b) Samarium Cobalt
(c) Neodymium (d) All of the above

(ISRO DT. 02.06.2019)
(L.P.)-2012), (IOF 2015)
(R.R.B. Jammu-Shrinagar (L.P.)-2008)

Ans : (d) Permanent magnets are made up of Alnico, Samarium Cobalt and Neodymium.

153. The ratio of magnetisation intensity to the magnetisation force is known as

(a) Susceptibility (b) Flux density
(c) Relative permeability (d) None of these

(ISRO DT. 02.06.2019)

Ans : (a) The ratio of magnetisation intensity to the magnetisation force is known as susceptibility.

$$\text{Susceptibility}(\chi) = \frac{\text{Magnetisation intensity}(I)}{\text{Magnetisation force}(H)}$$

154. Degaussing is the process of

(a) Elimination of remnant magnetic field
(b) Remagnetising metallic part
(c) Removing nonmagnetic impurities from magnetic material
(d) Removing trapped gas from magnetic material

(ISRO DT. 02.06.2019)

Ans : (a) Degaussing is the process of elimination or decreasing remnant magnetic field. Due to magnetic hysteresis, it is generally not possible to reduce a magnetic field completely to zero.

155. Which type of magnet is used in an electric bell?

(a) Rare-earth magnet (b) Electromagnet
(c) Carbon magnet (d) Permanent magnet

Bihar TG -2, 03.11.2018, [Batch - 3]

Ans : (b) Electromagnet is used in an electric bell.

- When push ON button is pressed then it completes its circuit through which current starts flowing so that it produce magnetic field and due to its magnetic field as a nature attract and produce alarm.

156. What is full form of MMF?

(a) Magneto-metallic force
(b) Magneto-motive force

(c) Magneto-movement force
(d) Magneto-motor force

UPPCL TG-2 (Date : 24-01-2019) Shift-I
UPPCL TG-2 (Date : 24-01-2019) Shift-II

Ans : (b) The full form of MMF is magneto-motive force.
MMF is analogous to electro-motive force or voltage in electric circuit. The standard unit of magneto- motive force is ampere-turn (AT)

$$\boxed{MMF = NI}$$

Where, N = Number of turn
I = Current

157. In the B-H curve, B represents.
(a) Magnetic field
(b) Magnetic flux
(c) Reluctance
(d) Magnetic flux density

UPPCL TG-2 (Date : 24-01-2019) Shift-II

Ans : (d) In the B-H curve, B represents magnetic flux density and H represents magnetic field strength.

158. In a 1000 turn coils, 6mWb flux is produced by 5 Ampere current which links with coil then what will be the inductance of coil?
(a) 1.2 H (b) 1.2 mH
(c) 0.833 H (d) 1200 H

UPPCL TG-2 (Date : 25-01-2019) Shift-I

Ans : (a) Given-
Turn(N) = 1000 turn
Current(I) = 5 Amp
Flux(ϕ) = 6 mWb = 6×10^{-3} Weber
Inductance(L) = ?

Formula, $\boxed{L = \frac{N\phi}{I}}$

$$L = \frac{1000 \times 6 \times 10^{-3}}{5}$$

$$\boxed{L = 1.2H}$$

159. Fleming's left hand rule is applicable to _____.
(a) Alternator (b) DC generator
(c) DC motor (d) Transformer

UPPCL TG-2 (Date : 25-01-2019) Shift-I
(ISRO Electronics Mechanic 2016)
(UPPCL-TG-2 Electrician-2015)

Ans : (c) Fleming's left hand rule is applicable to DC motor.
■ Fleming's right hand rule is applicable to DC generator.

160. Choose the ferromagnetic material from the following options.
(a) Cobalt (b) Copper
(c) Gold (d) Lead

UPPCL TG-2 (Date : 25-01-2019) Shift-I

Ans : (a) Cobalt is a ferromagnetic material.
■ Ferromagnetic materials have strong attraction power.
■ Relative permeability of ferromagnetic material is very high i.e. in range of 1000 where it is less than unity for diamagnetic material.

161. Curie point is that temperature above which ferromagnetic material becomes -------

(a) Paramagnetic (b) Conductor
(c) Insulator (d) Diamagnetic

UPPCL TG-2 (Date : 25-01-2019) Shift-II

Ans : (a) Curie point is that temperature above which ferromagnetic material becomes paramagnetic.

- Antiferromagnetic material, above neel temperature it becomes paramagnetic material.
- Curie temperature of some ferromagnetic materials are-

  Ni $\rightarrow$ 354°C (627 °K)
  Fe $\rightarrow$ 770°C (1043 °K)
  Co $\rightarrow$ 1121°C (1400 °K)

162. If mutual inductance between two coils is 5H and if current in one changes at rate 2A/s then induced emf in other coil will be-

(a) 10 V (b) 2.5 V
(c) 2 V (d) 5 V

UPPCL TG-2 (Date : 25-01-2019) Shift-II

Ans : (a) Given that,

Mutual inductance (M) = 5 H

$$\frac{di}{dt} = 2 \text{ A/s}$$

emf (e) = ?

$$\boxed{\text{emf}(e) = M.\frac{di}{dt}}$$

$$e = 5 \times 2$$

$$\boxed{B = \frac{\phi}{A}}$$

163. Which of the following has B-H curve of straight line?

(a) Soft iron (b) Silicon steel
(c) Mild steel (d) Air

UPPCL TG-2 (Date : 25-01-2019) Shift-II
MP Line Attendant 24.07.2018

Ans : (d) B-H curve of Air is straight line or we can say it linear curve because there is absence of magnetic saturation and hence there is no hysteresis and eddy current loss if BH curve is linear.

164. The rate of change in current is maximum on inductive coil at the instant of -

(a) After a cycle
(b) At start of current flow
(c) Near to final value of current
(d) At 36.8% of its maximum value

MPPKVVCL Line Attendant 26.03.2017

Ans : (b) At the start of current flow the rate of change in current is maximum in a inductive coil.

Rate of change in current = $\frac{di}{dt}$

At instant of start of current di has finite value but dt is very less time approx zero.

Hence $\frac{di}{dt}$ will be maximum.

165. Where are the magnetic field lines oriented?

(a) North to south (b) South to north
(c) Negative to positive (d) In both directions

Haryana Shifting Assistant2016 Shift-II
MP Line Attendant 24.07.2018
ISRO Bangaluru Tech 27.11.2016

Ans : (a) The magnetic field lines are oriented in north to south and inside south to north.

166. Which of the following is not a property of magnet ?

(a) A suspended moves in north and south pole
(b) Produce magnetism in nearer magnet by induction
(c) Dissimilar poles repels and similar attracts each other
(d) Magnetic materials like iron and steel are attracted

ISRO Ahmedabad Tech 29.04.2018

Ans : (c) Properties of magnet are as follows -

- Similar poles repel and dissimilar poles attract each other.
- Magnet attract ferromagnetic material like iron & steel .
- A suspended magnet always comes to rest in north and south direction.
- Pole of magnet are always in pairs.

167. Iron, nickel and cobalt _____ are materials.

(a) Ferromagnetic
(b) Temporary magnetic
(c) Diamagnetic
(d) Paramagnetic

PGCIL Tech. 14.11.2018

Ans : (a) Iron, nickel and cobalt ferromagnetic are materials.

168. Magnetic fields are produced by which of the following reason.

(a) Due to static charge dynamic
(b) Due to only positive charge
(c) Due to only negative dynamic charge
(d) Due to both positive and negative dynamic charge

MP Line Attendant 23.07.2018

Ans : (d) Magnetic field are produced by both positive and negative moving charge or we can say that moving electric charge.

■ A moving electric charge means current is flowing and the relation between magnetism and electricity is given by Oersted.

169. What is magnetic moment?

(a) It is a scalar quantity
(b) It is a vector quantity
(c) It is a universal constant
(d) It shows pole strength

MP Line Attendant 24.07.2018
[DMRC Maintainer 13.04.2018, 9 -10:30 am]

Ans : (b) Magnetic moment is a vector quantity.

■ Magnetic moment is the measure of object tendency to align with a magnetic field.

■ It is also known as magnetic dipole

170. The polarities remain constant in which of the following magnets?

(a) Temporary magnet
(b) Both permanent and temporary magnets
(c) Magnetic field
(d) Permanent magnet

[DMRC Maintainer 09.04.2018, 9.00 -10:30 am]

Ans : (d) The polarities of permanent magnet remains constant magnetic strength of permanent magnet.
Permanent magnets are made up from steel, carbon steel and cobalt.
(i) Bar magnet
(ii) U shaped magnet
(iii) Horse shoe magnet
(iv) Magnetic needle
(v) Ball magnet

171. A permanent magnet moving coil instrument consists of a powerful permanent magnet with……..?
(a) Copper wire (b) Soft iron rod
(c) Aluminium (d) Platinum
[DMRC Maintainer 11.04.2018]

Ans. (b) : A permanent magnet moving coil instrument consists of a powerful permanent magnet with soft iron rod.

172. The attractive force of a magnet is maximum-
(a) Magnetic pole (b) Magnetic field
(c) Magnetic axis (d) Magnetic line of force
[DMRC Maintainer 13.04.2018, 9 -10:30 am]
[DMRC Maintainer 11.04.2018]

Ans. (a) : The attractive force of a magnet is maximum at magnetic pole.

173. The direction of force in a current carrying conductor can be determined using :
(a) Fleming's Right Hand Rule
(b) Fleming's First Rule
(c) Fleming's Left Hand Rule
(d) Faraday's Law
ALP, Technician 22.01.2019, [12:30-03:00]

Ans. (c) The direction of force in a current carrying conductor can be determined using Fleming's left hand rule.
Fleming's left hand rule- If we arrange our thumb, forefinger and middle finger of the left hand perpendicular to each other, then the thumb indicates the direction of the force experienced by the conductor, the forefinger indicates the direction of magnetic field and the middle finger indicates the direction of current.

174. Hysteresis losses are determined by which formula?
(a) $W_{cu} = \left(I_1^2 R_1 + I_2^2 R_2\right) W$
(b) $W_{cu} = \left(I_1^2 R_1\right) W$
(c) $W_e = K B_{max}^2 f^2 t^2 W$
(d) $W_h = \eta B_{max}^{1.6} f\, V\, W$
ALP, Technician 23.01.2019, [04:30-07:00]

Ans. (d) : Hysteresis losses are determined by the formula $W_h = \eta B_{max}^{1.6} f\, V\, W$.
Where, W_h = Hysteresis losses in watt
B_{max} = Maximum flux density in Wb/m^2
f = Frequency in Hz
V = Volume of core in m^3
η = Hysteresis constant

175. Which of the following two losses are together called core loss?

(a) Primary copper loss and secondary copper loss
(b) Copper loss and hysteresis loss
(c) Eddy current loss and hysteresis loss
(d) Connector loss and transmission loss

ALP, Technician 23.01.2019, [04:30-07:00]

Ans. (c) : Eddy current losses and hysteresis losses are called core loss.

■ Core loss in any machine is also known as Iron loss and fixed losses because this loss are constant irrespective of the load.

■ core loss = Eddy current loss + Hysteresis loss

i.e. $P_c = P_e + P_h$

$$P_c = KB_m^2.f^2t^2V + \eta B_m^{1.6} f\,V$$

176. Fleming's left hand rule does not indicate

(a) the voltage in the conductor
(b) the direction of the magnetic flux
(c) the direction of motion of the conductor
(d) the direction of current flow in the conductor

ALP, Technician 22.01.2019, [04:30-07:00]

Ans. (a) : Fleming's left hand rule does not indicate the voltage in the conductor.

Fleming's Left hand Rule- If we arrange our thumb, forefinger and middle finger of the left hand perpendicular to each other, then the thumb indicates the direction of the force experienced by the conductor, the forefinger indicates the direction of magnetic field and the middle finger indicates the direction of current.

177. The flux per unit area is called as?

(a) Magnetic intensity
(b) Magnetic reluctance
(c) Magnetic flux density
(d) Magnetic field strength

ALP, Technician 23.01.2019, [12:30-03:00]

Ans. (c) : The flux per unit area is called as magnetic flux density.

$$\boxed{B = \frac{\phi}{A}} \quad \text{Weber/m}^2 \text{ or Tesla}$$

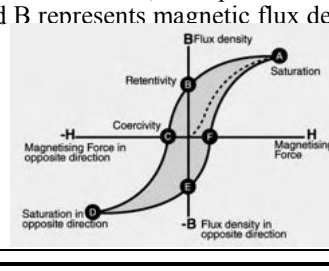
Where, B = Magnetic flux density
ϕ = Magnetic flux
A = Area

178. In a B-H curve, H represents?

(a) Magnetic flux density
(b) Magnetic field strength
(c) Magnetic flux
(d) Reluctance

ALP, Technician 23.01.2019, [12:30-03:00]

Ans. (b) In a B-H curve, H represents magnetic field strength and B represents magnetic flux density.

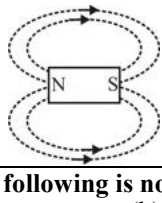


179. Which among the following is the direction of flow of line of force around a bar magnet ?

(a) Out of the east pole into the west pole
(b) Out of the west pole into the east pole
(c) Out of the south pole into the north pole
(d) Out of the north pole into the south pole

ISRO Technician Electrical 27.11.2016

Ans : (d) The direction of flow of line of force around a bar magnet is out from north pole entered into the south pole.



180. Which of the following is not unit of flux?

(a) Weber (b) Tesla
(c) Maxwell (d) All of these

(DMRC Maintainer Electrician 2017)

Ans : (b) Tesla is not unit of magnetic flux.

■ The unit of magnetic flux is weber or maxwell.

1 Weber = 10^8 Maxwell.

■ The unit of magnetic flux density is Tesla or gauss.

1 Tesla = 10^4 Gauss

181. While applying Fleming's right–hand rule to find the direction of induced e.m.f. the thumb points towards –

(a) Direction of induced emf
(b) Direction of flux
(c) Direction of motion of the conductor if forefinger points in the direction of generated emf
(d) Direction of motion of conductor, if forefinger points along the lines of flux

(UPPCL Electrician TG-2 Trainee 16.10.2016, Re-Exam)

Ans : (d) While applying Flemings right hand rule to find the direction of induced emf the thumb points towards the direction of motion of conductor, if fore finger points along the lines of flux . Middle finger indicates the direction of induced e.m.f.

182. When current in a conductor increases, then lenz's Law states that self induced voltage

(a) Will tend to increase the amount of current
(b) Will help the rising current
(c) Induced current in opposite direction
(d) Will support the applied voltage

(CRPF Overseer Electrician-2009)

Ans : (c) When current is a conductor increase then lenz's law states that self induced voltage will induce current in opposite direction such that the induced current produce flux which will tend to reduce the main flux . This law is given by Henrick lenz in 1833.

183. If a conductor is moved through a magnetic field–

(a) Heat is induced
(b) Voltage is induced
(c) The magnetic field is increased
(d) The magnetic field is decreased

(UPPCL Electrician TG-2 Trainee 16.10.2016, Re-Exam)

Ans : (b) If a conductor is moved through a magnetic field then voltage is induced in the conductor according to faraday's law of electromagnetic induction. The value of induced emf is directly proportional to number of turns in the coil and rate of change of flux linkage.

$$e = -N\frac{d\phi}{dt} \text{ volt}$$

184. In electromagnet the strength of a magnet can be varied

(a) By changing current only
(b) By changing number of turns only
(c) Either by changing current or by changing number of turns
(d) By changing voltage only

(UPPCL-2016, TG2 Exam Date : 26-06-2016)

Ans : (c) In an electromagnet the strength of a magnet can be varied either by changing current or by changing number of turns.

■ Magnetic field strength (H) = $\frac{NI}{\ell}$

185. Ferrite is associated with

(a) Ferromagnetic materials
(b) Paramagnetic material
(c) Diamagnetic materials
(d) Ferrimagnetic materials

(UPPCL-2016, TG2 Exam Date : 26-06-2016)

Ans : (d) Ferrite is associated with ferrimagnetic materials.

■ Above curie temperature ferrimagnetic material behaves as like paramagnetic material.
■ Magnetic susceptibility is positive and large.
■ Used to make core of high frequency transformer

186. When the current through the coil of an electromagnet reverses, the :

(a) Magnetic field expands
(b) Direction of the magnetic field remains unchanged
(c) Direction of the magnetic field reverses
(d) Magnetic field collapses

(UPRVUNL-TG2 Instrumental-2015)

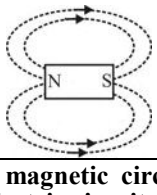
Ans : (c) When the current through the coil of an electromagnet reverses, the direction of magnetic field reverses.

187. The direction of a magnetic field within a magnet is –

(a) From south to north (b) From north to south
(c) Back to front (d) Front to back

(UPRVUNL-TG2 Instrumental-2015)
(ISRO Technician Electrical 27.11.2016)

Ans : (a) The direction of magnetic field with in a magnet is from south to north and north to south outside of the magnet.



188. Permeance in magnetic circuit is analogous to which one in electric circuit .

(a) Current density (b) Resistance

(c) Conductance (d) Specific resistance

(UPPCL-TG-2 Electrician-2015)

Ans : (c) Permeance in magnetic circuit is analogous to conductance in electric circuit.

- Unit of permeance is Henry
- Unit of conductance is Siemens.

Analogous between magnetic and electric circuit-

Magnetic circuit	**Electric circuit**
Reluctance	Resistance
permeance	Conductance
Reluctivity	Resistivity
Permeability	Conductivity

189. At the time of using Fleming's left hand rule. which of the following indicates correct sign?

(a) Thumb-motion, forefinger-current, middle finger-magnetic field

(b) Thumb-magnetic field, fore finger-motion, middle finger-current

(c) Thumb-motion, forefinger-magnetic field, middle finger-current

(d) Thumb-current, forefinger- motion, middle finger-magnetic field

(UPPCL-TG-2 Electrician-2015)

Ans : (c) According to Fleming's left hand rule, If we arrange our thumb, forefinger and middle finger of the left hand perpendicular to each other, then the thumb indicates the direction of the force experienced by the conductor, the forefinger indicates the direction of magnetic field and the middle finger indicates the direction of current.

190. Hysteresis is the Phenomenon is the Magnetic Circuit by which.

(a) H Lags behind B

(b) B Lags behind H

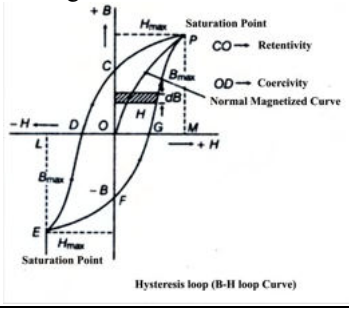
(c) B and H are always same

(d) Setting up a constant Flux is done

(UPPCL-TG-2 Electrical-2014), (IOF 2013)

Ans : (b) Hysteresis is the phenomenon in the magnetic circuit by which B lags behind H.

Magnetic hysteresis is the quality of a magnetic substance, due to which energy is dissipated in it on the reversal time magnets.



Hysteresis loop (B-H loop Curve)

191. Which of the following statement is correct?

(a) Similar poles attracts each other

(b) Humming noise in transformer is produced in its winding

(c) Unit of magnetic flux is Weber

(d) Voltmeter is connected in series in a circuit

(DMRC Maintainer Electrical-2014)

Ans : (c) Unit of magnetic flux is Weber.

$$\text{Magnetic flux}(\phi) = \frac{\text{mmf}(NI)}{\text{Reluctanc}(S)}$$

- Similar poles repel each other where as different poles attract each other
- Humming noise in transformer produced in magnetostriction.
- Voltmeter are connected in parallel in any circuit for voltage measurement.

192. Hysteresis loss in a magnetic materials depends upon :

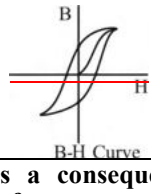
(a) Area of hysteresis loop
(b) Frequency of reversal of field
(c) Volume of magnetic material
(d) All of these

(DMRC Maintainer Electrician 2017)

Ans : (d) Hysteresis loss in a magnetic materials depends upon area of hysteresis loop, frequency of reversal of field and volume of magnetic materials.

$$\text{Hysteresis loss} = \eta\ B_{max}^{1.6}\ fV$$

η = Hysteresis co-efficient
B = Flux density
f = Frequency
V = Volume



B-H Curve

193. Lenz's law is a consequence of the law of conservation of–

(a) ~~Charge~~ (b) Induced current
(c) Energy (d) Induced e.m.f.

UPPCL Electrician TG-2 Trainee 16.10.2016, Re-Exam, (IOF 2012)
UPPCL-TG-2 Electrical-2014
GSSSB Electronics Instructor 21.01.2014

Ans : (c) Lenz's law is a consequence of law of conservation of energy

- Kirchhoff's current law is based on conservation of charge.
- Direction of induced e.m.f can be obtained from Fleming right hand rule
- Induced emf can be obtained by Faraday law of electromagnetic induction.

194. "In electromagnetic induction, induced emf = – (Rate of change of magnetic flux). The '-' (minus) sign is an outcome of:

(a) Lenz's Law (b) Faraday's Law
(c) Biot savart's Law (d) Ampere's Law

UPPCL Technical Grade-II Electrical 11.11.2016

Ans : (a) In electromagnetic induction, induced emf = (Rate of change of magnetic flux). The '-' sign is outcome of Lenz's law to show that it opposes the cause by which it has been produced.
Lenz law is based on the law of conservation of energy.

195. Susceptance is the reciprocal of_____.

(a) Admittance (b) Conductance
(c) Resistance (d) Reactance

UPPCL Technical Grade-II Electrical 11.11.2016

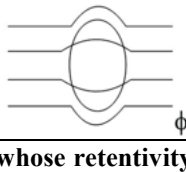
Ans : (d) Susceptance is the reciprocal of reactance.
- Unit of susceptance is Siemens or mho.
- Unit of reactance is ohm.
- Capacitive susceptance taken as positive and inductive susceptance as negative.

196. The substance which is repelled by a slightly magnet is called-

(a) Magnetic (b) Diamagnetic
(c) Paramagnetic (d) Ferromagnetic

(R.R.B. Ranchi (L.P.)-2005)

Ans : (b) The substance which slightly repelled by a magnet is called diamagnetic material.
- Susceptibility of diamagnetic materials is negative hence, relative permeability is less than one.
- examples- copper, Bismuth, gold, Diamond, wood etc.



197. The material whose retentivity is high is suitable for making -

(a) Temporary magnet
(b) Electromagnet
(c) Permanent magnet
(d) Permanent and Temporary magnet both

(R.R.B. Bhubaneshwar (L.P.)-2012), (IOF 2015)

Ans : (c) The material whose retentivity is high is suitable for making permanent magnet such material comes under hard ferromagnetic material They have very high coercive force.
Hence very difficult to magnetize and demagnetize.
For example- Nickel and Cobalt steel.
major application in loudspeakers.

198. The material used for shielding or screening of magnetism is–

(a) Soft iron (b) Aluminium
(c) Copper (d) Zinc

R.R.B. Allahabad (L.P.)-2007

Ans : (a) The materials used for shielding or screening of magnetism is soft iron.
Shielding is the covering used to provide protection or interference of external magnetic field.

199. If value of magnetic flux is ϕ ,and area under its influence is A, then value of magnetic flux density is-

(a) $B = \phi.A$ (b) $B = \frac{\phi}{A}$

(c) $B = \frac{A}{\phi}$ (d) $B = \phi.A$

UPRVUNL TG-2, 17.07.2021 Shift I
KPSC Lineman Exam, 19.01.2021
DSSSB Instructor Electrician-06.10.2019
RSMSSB Junior Instructor Electrician 24.03.2019
KPSC Instructor 16.01.2017
GSSSB Instructor Electrical 15.11.2016
(R.R.B. Mumbai (L.P.)-2012), (IOF 2014)
Punjab Electrical Instructor 7.07.2013
Punjab Wireman Instructor 7.07.2013

Ans : (b) Magnetic flux density is the total flux per unit area is called magnetic flux density.

$$B = \frac{\phi}{A}$$

Where, B = Magnetic flux density

ϕ = Magnetic flux

A = Area

The unit of magnetic flux density is weber per meter square.

200. Relative permeability of paramagnetic material is-

(a) Less than unity
(b) Unity
(c) Slightly more than unity
(d) Very high than unity

(R.R.B. Kolkata (L.P.)-2014)

Ans : (c) Relative permeability of paramagnetic material is slightly more than unity.

■ It has positive susceptibility but small.

Example- Aluminium, Tin, Platinum, Magnesium etc.

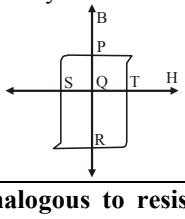
■ As temperature increase , susceptibility decreases because randomness increases.

201. Which material is suitable for making permanent magnet?

(a) Carbon steel (b) Alnico
(c) Alcomax (d) All of these

(R.R.B. Kolkata (L.P.)-2014)

Ans : (d) Carbon steel, Alnico and Alcomax, material are suitable for making permanent magnet. because these materials have wider BH curve. It has higher coercivity and retentivity.



202. -------- is Analogous to resistance in magnetic circuit

(a) Permeance (b) Reluctance
(c) Impedance (d) Conductance

R.R.B. Kolkata (L.P.)-2014

Ans : (b) Reluctance is analogous to resistance in magnetic circuits.

■ Reluctance $= \frac{\ell}{\mu_0 \mu_r A}$ Henry^{-1}

■ Reluctance $= \frac{MMF}{Flux}$ or $\frac{NI}{\phi}$

■ Reluctance is reciprocal of permeance.

■ Permeance is analogous to conductance in electric circuit.

203. Electromagnet is made up of-

(a) Soft iron (b) Hard steel
(c) Copper (d) Tin

ESIC Electrician-2016
R.R.B. Secunderabad (L.P.)-2010

Ans : (a) Electromagnet is made up of soft iron.

- Electromagnet are temporary magnet which behaves as magnet only when current is flowing through the coil. As soon as electric current supply is cut off if loses it magnetic property.
- **Properties of soft magnetic materials i.e electromagnet.**

(i) High relative permeability
(ii) Low coercive force
(iii) Extremely small hysteresis
(iv) Easily magnetized and demagnetized.

Example- Iron and its alloy with nickel, iron-silicon alloy, nickel-iron alloy, iron, silicon steel.

204. Which of the following metals do not attracted by magnet?

(a) Cobalt (b) Nickel
(c) Iron (d) Aluminium

R.R.B. Ranchi (L.P.)-2005

Ans : (d) Aluminium does not attracted by magnet because it is non magnetic material because of its crystal structure. Where as Aluminium comes under paramagnetic materials.

- Magnetic materials – Iron, Nickel, Cobalt, steel**.**
- Non-magnetic materials – Aluminium, gold, silver, copper.

205. In a magnetic circuit, the ratio of the total volume taken up by the magnetic material to the total volume of the core is called------

(a) Leakage factor (b) Stacking factor
(c) Form factor (d) Crest factor

UPPCL (TG-2) 09.11.2023, Shift-I
UPPCL TG-2, 20.03.2021 Shift II

Ans. (b) : In a magnetic circuit, the ratio of the total volume taken up by the magnetic material to the total volume of the core is called stacking factor.

- Stacking factor is also called lamination factor or space factor. This term used in design of electrical transformer or other electrical machine.
- The stacking factor is usually 0.9.

206. The temperature at which ferromagnetic materials converts into paramagnetic materials is called-

(a) Curie Temperature (b) Weiss temperature
(c) Critical temperature (d) All of these

R.R.B. Bengaluru (L.P.)-2004

Ans : (a) The temperature at which ferromagnetic material converts into paramagnetic material is called curie temperature.

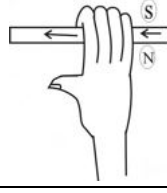
- Anti ferromagnetic material becomes paramagnetic material above neel temperature.
- Ferromagnetic material becomes paramagnetic material above curie temperature.

207. Which of the following statement is incorrect ?

(a) Direction of magnetic field induced by current carrying conductor can be determined by left hand thumb rule
(b) In domestic wiring earth wire is green
(c) Kilowatt-hour is general unit to represent power dissipation
(d) All of these

R.R.B. Ahmedabad (L.P.)-2012, (IOF 2015)

Ans : (a) Statement (a) is incorrect because right hand thumb rule is used to find the direction of magnetic field in a current carrying conductor . According to this rule if thumb is pointed in the direction of current flow then curl of finger indicates direction of magnetic field.



208. Which electromagnetic radiations have highest frequency ?

(a) γ-Rays (b) X-Rays
(c) Infrared Rays (d) All of these

R.R.B. Chennai (L.P.)-2008

Ans : (a) γ- Rays have highest frequency.

Property of γ-Rays-
(i) Highest Frequency
(ii) Shortest Wavelength

209. Direction of induced emf is such that it opposes the cause. This statement is of -

(a) Kirchhoff's law (b) Lenz's law
(c) Srew's law (d) Fleming law

R.R.B. Kolkata (L.P.)-2012

Ans : (b) The direction of induced emf is such that it opposes the cause. This statement is Lenz's law.

■ This law is based on the law of conservation of energy. Lenz's law is conveyed by negative sign in the equation of emf $\boxed{e = -L\frac{di}{dt}}$.

210. Henry is the unit of which one?

(a) Frequency
(b) Magnetic field
(c) Inductance
(d) Potential difference

R.R.B. Gorakhpur (L.P.)-2007

Ans : (c) Henry is the unit of inductance.
Inductance is the property of a inductor by the virtue of which it opposes the change in rate of current.

Self inductance $(L) = \frac{\mu_0 \mu_r N^2 A}{\ell}$ Henry.

$= \frac{N\phi}{I}$ Henry

■ Unit of magnetic flux is Weber
■ Unit of magnetic field density is Weber/m^2 or Tesla.

211. What is symbol of inductance ?

(a) Y (b) H
(c) L (d) X

R.R.B. Ranchi (L.P.)-2006

Ans : (c) L is symbol of inductance and its unit is henry.

Symbol		**Parameter**
Y	→	Admittance
H	→	Magnetic field strength
X	→	Reactance

212. Magnetic needle of a tangent galvanometer is very small but magnetic field is -

(a) Zero
(b) Uniform in center and small
(c) Very large
(d) None of these

R.R.B. Bengaluru (L.P.)-2010

Ans : (b) Magnetic needle of a tangent galvanometer is very small but magnetic field is uniform in center and small.

213. Speed of electromagnetic wave and light is-

(a) Speed of first is more than second
(b) Both have same speed
(c) Speed of second is more than first
(d) None of these

R.R.B. Bengaluru (L.P.)-2010

Ans : (b) Speed of electromagnetic wave and light is same because light waves are also a type of electromagnetic waves. This speed is approx 3×10^8m/s.

214. Magnetic flux of fully saturated electromagnet can be increased by-

(a) Increasing eddy current
(b) Increasing voltage
(c) Increasing core area
(d) Increasing number of turns

R.R.B. Mumbai (L.P.)-2008

Ans : (d) Magnetic flux of fully saturated electromagnet can be increased by increasing number of turn. It can be increasing either by increasing number of turns or by increasing current through it but here in this case electromagnet is saturated i.e. an increasing current value of flux will not increasing .
Hence, it is only possible by increasing the number of turns.

215. A constant current is flowing through a solenoid .If a bundle of iron is placed in it then value of magnetic field inside the solenoid is----

(a) Increase
(b) Decrease
(c) First increase, after that decrease
(d) None of these

(R.R.B. Chennai (L.P.)-2012)

Ans : (a) A constant current is flowing through a solenoid if a bundle of iron is placed in it then magnetic field inside it will increase because of permeability which increased due to iron.

216. Which of the following have maximum wavelength in electromagnetic waves?

(a) Infrared Rays (b) Gamma Rays
(c) Ultraviolet Rays (d) Beta Rays

(R.R.B. Chennai (L.P.)-2012)

Ans : (a) Infrared rays have maximum wavelength in the given options.

Wavelength -

Gamma rays < X-Rays < Ultraviolet rays < Infrared rays < Micro waves < Radio waves

Frequency-

Gamma rays > X-Rays > Ultraviolet > Infrared Rays > Microwaves > Radio waves.

217. Magnetic field have-

(a) Only south pole
(b) Only north pole
(c) Both south and north pole
(d) None of these

R.R.B. Mumbai (L.P.)-2010

Ans : (c) Magnetic field have both north and south poles.

■ Single poles i.e. either north or south never exist individually.

■ North pole is the source of magnetic field originates from north pole and enter into south pole.

218. Magnetic needle indicates in which direction ?

(a) East (b) West
(c) North (d) South

R.R.B. Allahabad (L.P.)-2012

Ans : (c) Magnetic needle indicates in the direction of north.

219. The ____ low which established relationship between electric flux across any closed surface and charge enclosed by surface.

(a) Gauss (b) Ohm
(c) Faraday (d) Ampere

R.R.B. Bengaluru (L.P.)-2004

Ans : (a) Gauss law established relation between electric flux across any closed surface and change enclosed by surface.

According to gauss law: Electric flux across any closed surface is proportional to the net electric charge inclosed by that surface.

i.e. $\boxed{\phi_E = \frac{q}{\varepsilon_0}}$

220. Polarization process of electromagnetic waves proves that electromagnetic waves are-

(a) Sinusoidal
(b) Transverse
(c) Longitudinal
(d) Both longitudinal, transverse

R.R.B. Kolkata (L.P.)-2008), (IOF 2012

Ans : (b) Polarization process of electromagnetic waves proves that electromagnetic waves are transverse wave.

■ Longitudinal waves cannot be polarized.

■ Light wave, radio waves, gravitational waves exhibit polarization.

221. Mutual inductance coefficient of a coil is 5H. If current in primary coil reduced to zero from 5A in just 10^{-3} seconds then induced emf in secondary coil is -

(a) Zero (b) 25000V
(c) 2500V (d) 2510V

R.R.B. Secunderabad (L.P.)-2010

Ans : (b) Given that,

Mutual inductance (M) = 5H
di = (5-0)A
dt = (10^{-3})sec

Formula,

$$e = M\frac{di}{dt}\text{Volt}$$

Now

$$e = 5 \times \frac{5}{10^{-3}}$$

$$e = 25000 \text{Volt}$$

222. If number of turn and length of core of any inductive coil is doubled then what will be its self inductance-

(a) Half (b) Double
(c) Four times (d) Unaffected

(R.R.B. Secunderabad (L.P.)-2004)

Ans : (b) Self inductance $(L) = \frac{\mu_0 \mu_r A N^2}{\ell}$ Henry

$$\boxed{L \propto \frac{N^2}{\ell}}$$

$$\frac{L_2}{L_1} = \left[\frac{N_2}{N_1}\right]^2 \cdot \left[\frac{\ell_1}{\ell_2}\right]$$

According to question- $N_2 = 2N_1$ & $\ell_2 = 2\ell_1$

$$L_2 = L_1 \left[\frac{2N_1}{N_1}\right]^2 \left[\frac{\ell_1}{2\ell_1}\right]$$

$$L_2 = L_1 \times \frac{4}{2}$$

$$\boxed{L_2 = 2L_1}$$

Hence, self inductance gets double.

223. A Electromotive force is statically induced emf if-

(a) When flux linking to coil varies
(b) When flux linking to coil is constant
(c) When conductor moves in magnetic field and cuts flux
(d) All of these

R.R.B. Trivendrum (L.P.)-2005, (IOF 2014)

Ans : (a) A Electromotive force is statically induced emf if flux linking to the coil varies.

■ **Statically induced emf-**No moving part .

Rate of change of flux linkage is obtained by alternating or varying flux such as sinusoidal flux.

■ **Dynamically induced emf-** At least one moving part either conductor or magnetic field or relative motion between them in required for rate of change in flux linkage.

224. Which is used as core in electromagnet?

(a) Hard iron (b) Soft iron
(c) Copper (d) Tin

(R.R.B. Gorakhpur (L.P.)-2014)

Ans : (b) Soft iron is used as core in electromagnet because for electromagnet permeability should be higher and retentivity should be low.

■ Electromagnet is a device which have capability to produce magnetic field in which current is flowing through it.

225. When permanent magnet is break into two piece-

(a) Magnetism vanishes in both parts
(b) Each part have one south and one north pole

(c) Each part have only one part
(d) None of these

KPSC Lineman Exam 19.01.2021
NMRC Maintainer 07.03.2017, 12.00–02.15 pm
R.R.B. Ranchi (L.P.)-2009

Ans : (b) When permanent magnet is break into two piece then each part have one south and one north pole, because single pole cannot exist individually. It's a property of magnet and permanent magnet have capability to produce magnetic field for a long time even if it breaks into several pieces. Permanent magnets are makes of Carbon steel, Cobalt steel etc.

226. What happens when any electron is passing through magnetic field?
(a) Its energy will increase
(b) Its velocity will be extra high
(c) Velocity and energy increase
(d) Velocity and energy constant

(R.R.B. Ranchi (L.P.)-2012), (IOF 2015)

Ans : (d) When any electron is passing through magnetic field then velocity and energy will be constant because work done by magnetic Force on any moving charge particle is zero and hence velocity will remains same.

227. Which of the following is not a class of permanent magnet material used for electric machines?
(a) Alnicos (b) Ceramics
(c) Silicon (d) Samarium cobalt

APSSB Instuctor Electrician 18.09.2021

Ans. (c) : Silicon is not used in making permanent magnet used for electrical machine.
- Generally ferromagnetic materials are used to make permanent magnet.
- Alnico (Aluminium + Nickel + Cobalt) is used most for permanent magnet.

228. The polarity of induced voltage while a field is collapsing is
(a) Independent of the force creating the field
(b) Opposite to the force creating the field
(c) Identical to the force creating the field
(d) Present only if the force is stationary

Gujrat Electrical Instructor 01.01.2022

Ans. (b) : The polarity of induced voltage is opposite to the force creating the field when field is collapsing.
- According to Lenz law always such that it will create the flux opposite to the main flux by which voltage has been induced. This law is the consequence law of conservation of energy.

229. It is difficult to magnetise steel because of its
(a) High density (b) High retentivity
(c) Low permeability (d) High permeability

Gujrat Electrical Instructor 01.01.2022

Ans.(c): It is difficult to magnetise steel because of its low permeability .
- Permeability of steel is 5.0×10^{-3} Henry.
- Steel is used to make permanent magnet.

230. As per the concept of analogy between electric and magnetic circuits, ...is the analogy pair
(a) Conductivity-Permeability
(b) Field Density- Field intensity H
(c) Current-charge
(d) Conductivity-permitivity

West Bengal Electrical Engineering Instructor 23-05-2021

Ans. (a) : As per the concept of analogy between electric and magnetic circuits, conductivity is analogous to permeability.

Analogy between magnetic & Electric circuit -

Magnetic circuit	Electric circuit
Electro motive force (emf)	Magneto motive force (mmf)
Reluctance (S) = $\frac{\ell}{\mu A}$	Resistance(R)= $\rho\frac{l}{A}$
Flux(ϕ) - weber	Current (I) – Ampere
Flux density (B)	Current density (J)

231. Out of the following the diamagnetic material is

(a) Aluminium (b) Nickel
(c) Cobalt (d) Copper

DSSSB Craft Instructor 10.02.2014

Ans.(d) : Copper is a diamagnetic material.

Diamagnetic materials are those materials which are repelled by magnetic field. For example- water, diamond, NaCl, Al_2O_3 etc.

■ Relative permeability is slightly less than one because susceptibility is negative.

■ Relative permeability of perfect diamagnetism is zero this is the condition for super conductors.

232. In a magnetic circuit the ratio of magneto motive force and reluctance is

(a) Magnetic permeability
(b) Magnetic field strength
(c) Magnetic flux density
(d) Magnetic flux

DSSSB Craft Instructor 10.02.2014

Ans. (d) : In a magnetic circuit the ratio of magneto motive force and reluctance is magnetic flux.

$$\text{Magnetic flux } (\phi) = \frac{\text{MMF}}{\text{Reluctance}} = \frac{\text{NI}}{\text{S}}$$

■ MMF is analogous to emf of electrical circuit.

233. Which of the statement is false for magnetic lines of force?

(a) They always form complete closed loop
(b) They behave as if they are not elastic
(c) Radiate from the north (N) pole to the south (S) pole
(d) They never intersect

DSSSB Craft Instructor 10.02.2014

Ans. (b) : Magnetic line of force are elastic hence statement 'b' is incorrect.

<u>Magnetic line of force</u> :-

(i) These lines always forms a closed loop.
(ii) These line radiates out from north pole to south pole outside the magnet and from south to north inside the magnet.
(ii) Magnetic line of force are elastic and these lines repel each other.

234. A magnetically soft material is characterized by

(a) Have low permeability
(b) Magnetic energy stored is low
(c) Have high coercive force
(d) Have high remanence

DSSSB Craft Instructor 10.02.2014

Ans. (d) : A magnetic soft material is characterized by high remanence.

■ Soft magnetic materials are those material which can be magnetise easily and its loses magnetic property quickly for example Alloy of Iron and silicon.

Properties of soft magnetic material -

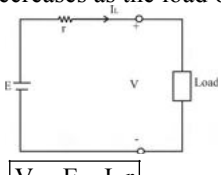
(i) Its hysteresis loop is narrow.
(ii) Its hysteresis loss is low.
(iii) Its permeability is high.
(iv) Its magnetic reluctance is low
(v) Its has lower coercive force
(vi) Its retentivity is less.

235. The terminal potential difference of a source of E.M.F. decreases as the load on it is

(a) Increased (b) Zero
(c) Decreased (d) Constant

DSSSB Craft Instructor 10.02.2014

Ans. (a) : The terminal potential difference of a source of emf decreases as the load on it is increased.



$$V = E - I_L r$$

As load increase – load current increase because load is always connected in parallel.

Hence value of voltage drop in internal resistance i.e. $I_L \times r$ increases which consequently decrease the terminal voltage.

236. Ampere turns/meter is the S.I. unit of

(a) Magnetic flux density
(b) Magneto motive force
(c) Magnetic field strength
(d) Reluctance

DSSSB Craft Instructor 10.02.2014

Ans. (c) : Ampere turns/meter is the S.I. unit of Magnetic field strength.

It is denoted by H.

$$H = \frac{NI}{l}$$

237. If number of turns in coil are doubled then inductance will be:

(a) Four times (b) Two times
(c) One-Fourth (d) Half

UKSSSC Electrician Instructor 16.06.2019
GSSSB Electronics Instructor 21.01.2014

Ans. (a) : Given that,

Turn (N_2) = $2N_1$ turns

$$L = \frac{N^2}{S} \text{ or } \frac{N^2 \mu_0 \mu_r a}{\ell}$$

$$L \propto N^2$$

So,

$$\frac{L_2}{L_1} = \left[\frac{N_2}{N_2}\right]^2$$

$$L_2 = L_1 \left[\frac{2N_1}{N_2}\right]^2 ----[N_2 = 2N_1]$$

$$L_2 = 4L_1$$

Hence, number of turns in coil are doubled then inductance will be four times.

238. Which of following is diamagnetic substance?

(a) Silver (b) Ferrite
(c) Zinc (d) Aluminium

UKSSSC Electrician Instructor 16.06.2019

Ans. (a & c) : Silver and Zinc are diamagnetic material because is has non unpaired electron present.

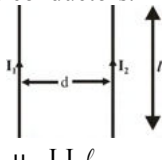
- Susceptibility of diamagnetic material is in the order of 10^{-5} to 10^{-6} and if relative permeability is smaller generally less than one.
- **Example-**Zinc, Silver, Gold, Copper, Silicon, Diamond, Wood etc.

239. The force between two long parallel current carrying conductors is inversely proportional to the

(a) Current in one conductor
(b) Product of current in two conductors
(c) Distance between the conductors
(d) Radius of conductors

MP Electrician Instructor 07.11.2016, Evening
KPSC Instructor Electrician 26.02.2016

Ans. (c) : The force between two long parallel current carrying conductors is inversely proportional to the distance between the conductors.



$$F = \frac{\mu_0}{2\pi}\frac{I_1 I_2 \ell}{d} \text{ Newton}$$

Where,

I_1 & I_2 = Current flowing in each conductor
d = Distance between two conductor
ℓ = Length of conductor
μ_0 = Absolute permeability of free space

240. In a coil, if a DC current is passed-

(a) An induced voltage is developed
(b) No induced voltage is developed
(c) The voltage is double in coil
(d) None of the above

MP Electrician Instructor 07.11.2016, Evening

Ans. (b) : In a coil, if a DC current is passed then no induced voltage is developed because in order to produce voltage there must be a changing flux linkage with respect to time. But in case of dc current $\frac{d\phi}{dt} = 0$.

Hence, $e = L = \frac{N\phi}{I}$

$\boxed{e = 0}$

241. Which of the following material does not retain magnetism permanently?

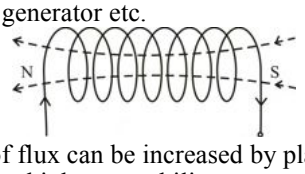
(a) Hardened steel (b) Stainless steel
(c) Nickel cobalt alloy (d) Soft iron

MP Electrician Instructor 07.11.2016, Evening

Ans. (d) : Soft iron does not retain magnetism permanently because of its low retentivity.

Temporary magnet– Those material which bears magnetic property whenever subject to any magnetic field and lost magnetic property when removed form effect of magnetic field.

Alloy of soft iron and silicon is used to make temporary magnet and these are used in electric clock, magnetic crane, motor, generator etc.



The amount of flux can be increased by placing a material having high permeability.

242. The core of a solenoid used is-

(a) Copper (b) Soft iron
(c) Aluminium (d) None of the above

MP Electrician Instructor 07.11.2016, Evening

Ans. (b) : The core of solenoid used is made of soft iron. solenoid is straight wire wound over a soft magnetic material or air to act as a bar magnet when ever current is flowing through the coil.

243. Self induced emf is the

(a) Emf induced due to the current flowing through a neighboring coil
(b) Emf developed in the coil due to its own inductance
(c) Voltage drop across the coil
(d) The current flowing through the coil

MP Electrician Instructor 07.11.2016, Evening

Ans.(b): Self induced emf is the emf induced or developed in the coil due to its current flowing through the coil.

i.e. When inductance of coil is L
and current through this coil is i

then induced emf $e = L\frac{di}{dt}$

244. Ferromagnetic substances are

(a) Good conductors
(b) Good insulators
(c) The same as that of diamagnetic material
(d) Strongly attracted by a magnet

MP Electrician Instructor 07.11.2016, Evening

Ans. (d) : Ferromagnetic substances are strongly attracted by a magnet because they have large number of unpaired electrons i.e. spin dipole moment which results in very high permeability.

- ferromagnetic materials lies in d block & s block of the periodic table.
- Example- iron, steel, Nickel, cobalt, dysprosium, Gadolinium etc.

245. The direction of magnetic lines of force is determined by:

(a) Right-hand rule
(b) Right-hand cork screw rule
(c) Both Right-hand rule and right-hand cork screw rule
(d) None of the above

MP Electrician Instruction 07.11.2016, Morning
UPRVUNL-TG2 Instrumental-2015
R.R.B. Ranchi (L.P.)-2007

Ans. (c) : The direction of magnetic line of force can be determined by right hand rule and right-hand cork screw rule both.

Cork screw rule-

Case I – If current flows from Bottom to Top then magnetic field → clock wise

Case II – If current flows from to bottom then magnetic field → Anti clock wise

246. A magnet is able to attract

(a) Iron, aluminium and brass
(b) Iron, copper and nickel
(c) Iron, cobalt and zinc
(d) Nickel ,cobalt and steel

MP Electrician Instruction 07.11.2016, Morning

Ans. (d) :A magnet is able to attract Nickel, Cobalt, and steel because these are ferromagnetic material having very high Permeability.

Aluminium, copper, Zinc are diamagnetic material and hence not attracted by magnet.

247. Static electromagnetic induction is adopted in the following AC machine.

(a) Generators (b) Alternators
(c) Transformers (d) All of the above

MP Electrician Instruction 07.11.2016, Morning

Ans. (c) : Static electromagnetic induction is adopted in transformer because there as no moving part in transformer. But the emf is developed due to alternating nature of flux setup by alternating current at supply.

248. A solenoid coil must have its-

(a) Length and breadth equal
(b) Length greater than breadth
(c) Breadth greater than length
(d) None of the above

MP Electrician Instruction 07.11.2016, Morning
KPSC Lineman Exam 21.04. 2016

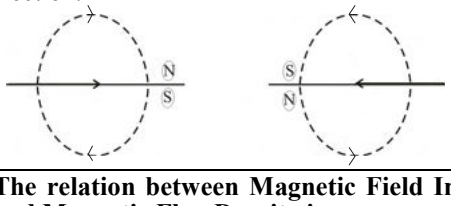
Ans. (b) : A solenoid coil must have its length greater than breadth in order to increase number of turns per unit length of solenoid. consequently it posses larger magnetic field.

249. A conductor current carrying is surrounded by a magnetic field exist in circles above the conductor is discovered by:

(a) Oersted (b) Faraday
(c) Henry (d) Lenz

MP Electrician Instruction 07.11.2016, Morning

Ans. (a) : A current carrying conductor is surrounded by a magnetic field exist in circles. Above the conductor is discovered by Oersted. According to him these circles are formed in either clockwise direction or in anti clock wise direction.



250. The relation between Magnetic Field Intensity and Magnetic Flux Density is.....

(a) $B = \mu H$ (b) $H = \mu B$
(c) $\mu = BH$ (d) $\mu HB = 1$

UPPCL (TG-2) 08.11.2023, Shift-I
HSSC Electronic/Electrical Instructor 12.12.2019, Shift-II

Ans. (a) : The relation between magnetic field intensity and magnetic field density is $B = \mu H$.

■ Magnetic field intensity is the force experienced on a unit pole placed at a point is denoted by 'H'.

$$\boxed{H = \frac{NI}{l}}$$

■ Magnetic flux density is the number of magnetic field lines passing through a unit area. It is denoted by 'B'.

$$B = \frac{\phi}{A}$$

251. It is difficult to magnetize steel because of its-

(a) Low permeability
(b) High permeability
(c) High density
(d) High retentivity

KPSC Instructor 16.01.2017
KPSC Lineman Exam 21.04. 2016

Ans. (a) : It is difficult to magnetize steel because of its low permeability.

■ Magnetic permeability$(\mu) = \frac{B}{H}$

■ Magnetic flux density$(B) = \frac{\text{Magnetic flux}(\phi)}{\text{Area}(A)}$

252. The magnetic potential in a magnetic circuit can be measured in terms of:

(a) Farad (b) Coulombs
(c) EMF (d) MMF

KPSC Instructor 16.01.2017

Ans. (d) : The magnetic potential in a magnetic circuit can be measured in terms of mmf. Force responsible for setting air flux in magnetic circuit is known as magneto motive force. MMF of any circuit is equal to the product of number of turns and current flowing through it.

$\boxed{MMF = NI}$ amp.turn

253. The electrical current is analogous to the magnetic circuit.....

(a) Flux (b) Reluctance
(c) Flux density (d) Permeability

KPSC Lineman-19.12.2021
ISRO (VSSC) Technician (B) 25.09.2016

Ans. (a) : The electrical current is analogous to the magnetic circuit flux.

Magnetic Circuit	**Electric circuit**
1. Flux(ϕ) $= \frac{\text{mmf}}{\text{Reluctance(S)}}$	**1.**Current(I) $= \frac{\text{emf}}{\text{Resistance(R)}}$
2. The unit of magnetic flux is Weber	**2.**The unit of current is ampere
3. The unit of magnetic flux density is Weber/m^2	**3.**The unit of current density is ampere/m^2
4. The unit of reluctance is per Henry	**4.**The unit of resistance is ohm

5. Reluctance(S) $= \frac{\ell}{\mu_o \mu_r a} AT/Wb$	**5.**Resistance $(R) = \frac{\rho \ell}{a} \Omega$
6.Permeance = $\frac{1}{\text{Reluctance}}$	**6.**Conductance = $\frac{1}{\text{Resistance}}$

254. The material slightly repelled by a magnet is called-

(a) Magnetic (b) Paramagnetic
(c) Diamagnetic (d) Ferromagnetic

KPSC Electrician -30.09.2020
Kerala PSC Wireman Instructor 26.02.2016

Ans.(c) : The material slightly repelled by a magnet is called diamagnetic materials.

Diamagnetic	**Paramagnetic**	**Ferromagnetic**
Very week magnetic field due to orbital revolution	Magnetic dipoles exists due to spin of unpaired electrons in an atom	Strong magnetic field
Susceptibility is negative	Susceptibility is small but positive	Very high susceptibility
Relative permeability is less than unity	Relative permeability is slightly more than unity	Relative permeability is much greater than 1.
Slightly repelled by magnet	Slightly attracted by magnet	Strongly Attracted by magnet
Copper, Bismuth, germanium, gold, diamond, wood, NaCl, Al_2O_3 etc.	Aluminum, Tin, platinum, magnesium, magnese	Ex- Iron, steel, Nickel, cobalt, Dysporsium, Gadolinium etc

255. To provide inductance in a circuit which is used-

(a) Resistor (b) Choke
(c) Capacitor (d) All of these

Kerala PSC Wireman Instructor 26.02.2016

Ans. (b) : To provide inductance in a circuit choke is used because in choke circuit consists of resistance (R) and inductance (L) connected in series . In this circuit current lags voltage by some angle.

256. In a coil current flowing 2A. If it has 200 turns then find the magneto motive force.

(a) 200 AT (b) 100 AT
(c) 300 AT (d) 400 AT

NVS Electrician Cum Plumber Instructor 08.03.2022

Ans. (d) : Given that,
Current (I) = 2 Amp
Turn (N) = 200 turn
MMF =?
Formula, MMF = NI
$= 200 \times 2$
= 400 Amp-turn

257. An air gap is usually inserted in magnetic circuits to.

(a) Increase the flux (b) Prevent saturation
(c) Increase m.m.f. (d) Decrease flux

GSSSB Instructor Electrician 27.03.2016

Ans. (b) : An air gap is usually inserted in magnetic circuits to prevent saturation because air gap is a non magnetic portion which reduces the amount of flux can be achieved and magnetizing current increase.
Hence, Possibility of saturation is decreased.

258. The ratio of intensity of magnetization I to the magnetizing force H is called.

(a) Flux density (b) Magnetic potential
(c) Permeance (d) Susceptibility

KPSC Instructor Electrician 16.09.2020
DMRC Maintainer 20.02.2020 (9.00-10.30)
KPSC Junior Instructor Electrician-28.09.2015

Ans. (d) : The ratio of intensity of magnetization (I) to the magnetizing force (H) is called susceptibility which is denoted by χ_m.

$$\chi_m = \frac{I}{H}$$

χ_m = +ve $\rightarrow$ Ferromagnetic & paramagnetic
= –ve $\rightarrow$ Diamagnetic

259. Which parameter in magnetic circuit is analogous to resistivity in electric circuit?

(a) Permeance (b) Permeability
(c) Reluctivity (d) Reluctance

KPSC Instrucor Electrician 16.09.2020

Ans. (c) : Reluctivity of magnetic circuit is analogous to resistivity of electric circuit.

Analogous between magnetic and Electric circuit:

Electrical circuit		Magnetic circuit	
(i)	Electric current (I)	(i)	Magnetic flux (ϕ)
(ii)	Electro motive force (EMF)	(ii)	Magneto motive force (MMF)
(iii)	Resistance (R)	(iii)	Reluctance (S)
(iv)	Current density (J)	(iv)	Magnetic flux density (B)

260. What is the force of magnetism?

(a) Magnetic lines (b) Magnetic fields
(c) Magnetic axis (d) Magnetic shielding

HSSC Electronics Mechanic Instructor 17.12.2019

Ans. (a) : Magnetic lines is the force of magnetism.

- Magnetic lines of force, indicate the region in which the force of magnet can be detected and this region is called the magnetic field .
- Magnetic lines of force, or flux, leave the north pole and enter the south pole.
- Tangent drawn to the magnetic field lines gives the direction of magnetic field.
- The closeness or density of the field lines is directly proportional to the strength of the field.

261. How can electrical current be induced with a coil and a magnet?

(a) By holding the coil and the magnet perfectly
(b) By moving either the magnet or the coil
(c) By placing the coil parallel to the magnetic field

(d) By placing the coil at right angles with the magnetic field

HSSC Electronics Mechanic Instructor 17.12.2019

Ans. (b) : By moving either the magnet or the coil electrical current can be induced within a coil. Force emf to be induced there must be a relative motion between conductor i.e. coil and magnetic field. The emf induced in this case is known as dynamically induced emf.

262. The lifting power of a magnet is-

(a) $B^2A/2\mu_0$ (b) $A^2B/2\mu_0$

(c) $B^2A/4\mu_0$ (d) $A^2B/4\mu_0$

KPSC Lineman Exam 21.04. 2016

Ans. (a) : The lifting power of a magnet is $B^2A/2\mu_0$

$$P = \frac{B^2A}{2\mu_0} \text{ Newton}$$

Where, B = Magnetic field density in Wb/m^2

A = Area in m^2

μ_0 = Absolute permeability of free space

263. What kind of magnetic substance is Water?

(a) Ferromagnetic (b) Nonmagnetic

(c) Paramagnetic (d) Diamagnetic

KPSC Lineman Exam 19.01.2021

Ans. (d) : Water is a diamagnetic material.

Properties of diamagnetic material-

- In the absence of external magnetic field there is no dipoles present.
- In this material magnetization (M) and field strength (H) are opposite to each other.
- They have negative susceptibility.
  Hence, relative permeability is less than unity.
- **Example-** Copper, Bismuth, water, wood, Gold, Diamond, Silicon, Germanium, NaCl etc.

264. In what direction internally the magnetic lines of force travel in bar magnet?

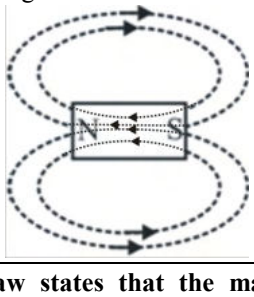
(a) North to south (b) South to north

(c) South to south (d) North to north

KPSC Lineman Exam 19.01.2021

Ans. (b) : Magnetic line of force travel from south to north internally in a bar magnet and from north to south externally.

- All these magnetic lines of force form closed loops.
- Two magnetic lines of force never cuts each other.
- Tangent drawn at any point of line indicates the direction of magnetic field lines.



265. Which law states that the magnitude of the induced emf is directly proportional to the rate of change of flux linkage?

(a) Faraday's First Law of Electromagnetic Induction

(b) Lenz's law
(c) Faraday's Second law of Electromagnetic induction
(d) End rule

KPSC Lineman Exam 19.01.2021

Ans. (c) : Faraday's second law of electromagnetic induction states that the magnitude of induced emf is directly proportional to the rate of change of flux linkage.

$$e \propto \frac{\phi_2 - \phi_1}{t}$$

i.e. $$e = -N\frac{d\phi}{dt}$$

Where,
– Sign due to Lenz law
e = induced emf
N = Number of conductors
$d\phi$ = Change in magnetic flux linkage
dt = Time in seconds

266. What is the expansion form MMF as regarding of electromagnetism?
(a) Magneto moto force
(b) Magnetic moto force
(c) Magneto motive force
(d) Magnetic motor force

KPSC Lineman Exam 19.01.2021

Ans.(c): Expansion form of mmf regarding electromagnetism is magneto motive force.
- Force responsible for setup the magnetic flux in magnetic circuit is called as magneto motive force.
- MMF = NI Ampere turn.

267. Whenever the magnetic flux linking with a conductor changes, an e.m.f. is induced in that conductor. The above statement is due to-
(a) Weber and Ewing's law
(b) Faraday's law of electrolysis
(c) coulomb's law
(d) Faraday's law of electromagnetic induction

KPSC Instructor Wireman 30.8.2016
GSSSB Electronics Instructor 21.01.2014

Ans. (d) : Whenever the magnetic flux linking with a conductor changes, an e.m.f. is induced in that conductor. The above statement is due to Faraday's law of electromagnetic induction.

i.e. $$e = -N\frac{d\phi}{dt}$$

Where, N = Number of turn
e = Induced electro motive force
$d\phi$ = Varying magnetic flux in Weber
dt = Varying time in second

268. According to Steinmentz Hysteresis law, the hysteresis loss in a material is proportional to;
(a) $B_m^{1.2}$
(b) $B_m^{1.6}$
(c) $B_m^{2.0}$
(d) $B_m^{2.6}$

KPSC Instructor Wireman 30.8.2016

Ans. (b) : According to Steinmentz hysteresis law the hysteresis loss in a material proportional to $B_m^{1.6}$.

$$\text{Hysteresis loss}\left(W_h\right) = \eta B_{max}^{1.6} f\, V \text{ watt}$$

Where,

η = Steinmentz hysteresis coefficient

B_{max} = Maximum flux density

f = Supply frequency

V = Volume of material

269. Which of the following is not a diamagnetic material?

(a) Air (b) Water

(c) Glass (d) Sulphur

KPSC Instructor Wireman 30.8.2016

Ans. (d) : Sulphur is not a diamagnetic material it is a paramagnetic material.

Example of diamagnetic material-

Air, water, Glass, Wood, Silicon, NaCl, etc.

270. Fleming's Right hand rule is used to indentify the :

(a) Direction of current in a motor

(b) Direction of rotation in a generator

(c) Direction of rotation in a motor

(d) Direction of induced emf

KPSC Instructor Wireman 30.8.2016

Ans. (d) : Flemings right hand rule is used to identify the direction of induced emf.

- Fleming's right hand rule is used for generating action of machine.
- Fleming's left hand rule is used for motoring action of machine.

271. A substance that has low retentivity can be used for the manufacture of ;

(a) Electromagnets (b) Permanent magnets

(c) Bar magnets (d) Paramagnets

KPSC Instructor Wireman 30.8.2016

Ans. (a) : A substance that has low retentivity can be used for the electromagnets.

- Electromagnets are a temporary magnets which works as magnet only when electric current is passed through it and quickly vanishes the magnetic effect through it when supply is interrupted.
- In order to demagnetize quickly material should have very low retentivity.

272. The total number of lines of force existing in a particular magnetic field is called

(a) Magnetic force (b) Magnetic flux

(c) Magnetic field (d) None of these

APSSB Instructor Wireman-19.09.2021

Ans. (b) : The total number of lines of force existing in a particular magnetic field is called magnetic flux. It is denoted by symbol ϕ.

- SI unit of magnetic flux is Weber.
- Magnetic flux is a scalar quantity.
- Total magnetic flux passing through a unit area is called flux density which is a vector quantity.

273. The current in a 200 mH coil increases from 2 to 5 A in 0.1 second. What is rate of change of current?

(a) 30 A/s (b) 20 A/s
(c) 10 A/s (d) None of these

Punjab Wireman Instructor 07.07.2013

Ans. (a) : Solve-

Given that,

Inductance (L) = 200 mH

Change in current (di) = 5 – 2 = 3A

Change in time (dt) = 0.1 sec

Now, $\frac{di}{dt} = \frac{3}{0.1} = 30\,\text{Amp/sec}$

274. Magnetism of a magnet can be destroyed by

(a) Heating
(b) Hammering
(c) By inductive action of another magnet
(d) By all above methods

GSSSB Instructor Electrical 15.11.2016

Ans. (d) : Magnetism of a magnet can be destroyed by using following methods

(i) By heating the magnet i.e. rise in temperature.
(ii) By hammering magnet repeatedly
(iii) By inductive action of another magnet if both fields are in opposite direction.

275. Air core coils are practically free from

(a) Hysteresis losses (b) Eddy current losses
(c) Both (a) and (b) (d) None of the above

GSSSB Instructor Electrical 15.11.2016

Ans.(c) : Air core coils practically free from hysteresis and eddy current losses.

- Air core and nonmagnetic materials have zero hysteresis and eddy current loss.
- Air core and non magnetic material having linear B-H curve, Hence no hysteresis loss.

276. Which of the following is not unit of magnetic flux?

(a) Maxwell (b) Tesla
(c) Weber (d) All of these

HPSSC Hamirpur Electrician Instructor 13.10.2019

Ans. (b) : Tesla is not unit of magnetic flux.

- Tesla is a unit of magnetic flux density.
- Weber is a unit of magnetic flux.

$$B = \frac{\phi}{A}\ \text{Weber/m}^2 \text{ or Tesla}$$

Where,

B = Magnetic flux density

ϕ = Magnetic flux

A = Area

277. Which one of the following is unit of inductance?

(a) Henry (b) Mho
(c) Ohm (d) kWh

KPSC Junior Instructor-19.8.2019

Ans. (a) : Henry is unit of inductance.

Formula - $L = \frac{N\phi}{I}$ Henry

Where,

N - Number of turn

I - Current

ϕ - Magnetic flux

L - Inductance

- Inductance is energy stored in form of magnetic field.
- Capacitance energy stored in form of electric field.

278. The magnet found in nature is known as

(a) Lodestone

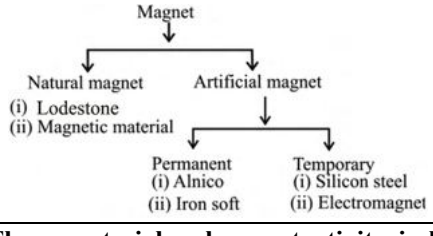
(b) Artificial magnet

(c) Diamagnet

(d) Permanent magnet

HPSSC Lineman Instructor 15.07.2018

Ans. (a) : The magnet found in nature is known as lodestone.



279. Those materials whose retentivity is high are used to make -

(a) Permanent Magnet (b) Bar Magnet

(c) Electro Magnet (d) Para Magnet

HPSSC Lineman Instructor 15.07.2018

Ans. (a) : Those materials whose retentivity is high are used to make permanent magnet.

280. One unit Weber is constituted by _____lines of force.

(a) 10^2 (b) 10^4

(c) 10^6 (d) 10^8

DSSSB Craft Instructor (ESM) 06.10.2019

Ans. (d) : One unit Weber is constituted by 10^8 lines of force. It is denoted by (ϕ) and SI unit is Weber.

1 Weber = 10^8 lines or Maxwell

281. Gauss's law for magnetism states that the net magnetic flux through any closed surface is -

(a) 1 (b) 2

(c) 3 (d) 0

RSMSSB Junior Instructor Electrician 24.03.2019

Ans. (d) : Gauss's law for magnetism states that the magnetic flux through any closed loop is zero.

$$\oint B \cdot dA = 0$$

i.e. divergence of B = 0

Thus $\nabla . \vec{B} = 0$ is consistence with the observation that shows isolated magnetic poles do not exist.

282. For diamagnetic materials χ is

(a) Neutral (b) Large

(c) Positive (d) Negative

RSMSSB Junior Instructor Electrician 24.03.2019

Ans. (d) : For diamagnetic material χ is negative. χ is known as magnetic susceptibility which is the measure of material to get magnetism when magnetic field is applied.

- χ = +ve implies that material is ferro or para magnetic
- χ = -ve implies that material is diamagnetic.
- $\mu_r = 1+\chi$ i.e. μ_r is less than unity for diamagnetic material.

283. The change of resistance in a magnetic field is called the-

(a) Magneto-resistance effect
(b) Seebeck effect
(c) Photo-electric effect
(d) None of the above

UKSSSC Tech. Electrical Instructor-21.11.2017

Ans. (a) : The change of resistance in a magnetic field is called the magneto resistance effect.

- Magneto-resistance is the tendency of a material (Ferromagnetic) to change the value of its electrical resistance in an externally applied magnetic field.
- **Seebeck effect** – When electricity is created between a thermocouple when the ends are subjected to a temperature.
- **Photoelectric effect** – Phenomenon in which electrically charged particles are released from electromagnetic radiations.

284. Relative permeability of vacuum is:

(a) $4\pi\times10^{-7}$H/m (b) 1H/m
(c) 1 (d) $1/4\pi$

DSSSB Instructor Electrician-06.10.2019
UKSSSC Tech. Electrical Instructor-21.11.2017

Ans. (c) : Relative permeability of vacuum is 1.
For the measurement of relative permeability vacuum or free space is chosen as the reference medium where permeability of free space is ($4\pi\times10^{-7}$ H/m) which is also known as absolute permeability (μ_0) of vacuum or free space.

$$\text{Relative permeability } (\mu_r) = \frac{\text{Permeability}(\mu)}{\text{Reference value}(\mu_0)}$$

$$\text{Relative permeability}\left(\mu_r\right) = \frac{4\pi\times10^{-7}}{4\pi\times10^{-7}} = 1$$

285. For resistance in electric circuit, the analogous quantity in magnetic circuit is

(a) Permittivity (b) Conductance
(c) Permeability (d) Reluctance

DSSSB Instructor Electrician-06.10.2019

Ans.(d) : For resistance in electric circuit, the analogous quantity in magnetic circuit is reluctance.

(Electrical Circuit)	(Magnetic Circuit)
emf (E)	mmf (F_m)
Current (I)	flux (ϕ)
Resistance (R)	Reluctance (S)
$\text{Current (I)} = \frac{E}{R}$	$\text{Flux}(\phi) = \frac{\text{mmf}}{S}$
$\text{Resistance (R)} = \rho\frac{\ell}{A}$	$\text{Reluctance (S)} = \frac{\ell}{\mu_0\mu_r A}$

286. The current in a 200 mH coil increases from 2 to 5 ampere in 0.01 second. The self induced E.M.F. is

(a) 3 V (b) 6 V
(c) 9 V (d) 12 V

DSSSB Instructor Electrician-06.10.2019

Ans. (b) : Given that,

Inductance (L) = 200 mH

Change in current (di) = (5 – 2) = 3A

Change in time (dt) = 0.01sec

Induced emf (e) = ?

Formula, $\boxed{e = L\frac{di}{dt}}$ volt

$$e = 200\times10^{-3}\times\frac{0.3}{0.01}$$

$$\boxed{e = 6 \text{ volt}}$$

287. The strongest of the diamagnetic material is

(a) Graphite (b) Glass
(c) Bismuth (d) Sulphur

DSSSB Instructor Electrician-06.10.2019

Ans. (c) : The strongest diamagnetic material is Bismuth.

- Graphite, Glass, Bismuth, Sulphur, Zinc marble, water, Copper all these materials are diamagnetic material.
- Pyrolytic graphite is also an usually strongly diamagnetic.

288. The property retentivity of material is useful on the construction of.

(a) transformers
(b) electromagnets
(c) permanent magnets
(d) non magnetic substances

KPSC Junior Instructor Electrician-28.09.2015

Ans. (c) : The property retentivity of material is useful on the construction of permanent magnets. If retentivity of permanent magnet be high it shows magnetic flux holding power of magnet.

289. The relation between magnetic field intensity and magnetic flux density is_____.

(a) B = μH (b) H = μB
(c) μ = BH (d) μHB = 1

HSSC Electronics/Electrical Instructor-12.12.2019

Ans. (a) : The relation between magnetic field intensity and magnetic flux density is B = μH

$$\boxed{B = \mu H}$$

$$\boxed{B = \mu_0\mu_r H}$$

Where,

B = Magnetic flux density (Wb/m^2)

μ_0 = Absolute permeability

μ_r = Relative permeability of material

H = Magnetic field strength (AT/m)

$\mu_0 = 4\pi\times10^{-7}$ H/m

290. It is the reciprocal of reluctance and implies the ease of readiness with which magnetic flux is developed

(a) Resistance (b) Conductance

(c) Permeance (d) Inductance

GSSSB Electronics Instructor 21.01.2014

Ans. (c) : Permeance is the reciprocal of reluctance and implies the ease of readiness with which magnetic flux is developed.

$$\text{Permeance} = \frac{1}{\text{Reluctance}}$$

291. The emf induced in a coil due to the changing current of another neighboring coil is called-

(a) Mutually induced emf

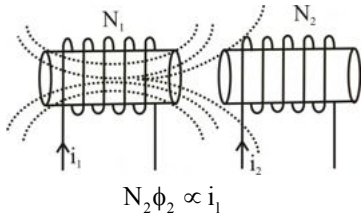
(b) Self induced emf

(c) Statically induced emf

(d) Dynamically induced emf

GSSSB Electronics Instructor 21.01.2014

Ans. (a) : The emf induced in a coil due to the changing current of another neighboring coil is called mutually induced emf.



$$N_2\phi_2 \propto i_1$$

$$N_2\phi_2 = Mi_1$$

$$\boxed{M = \frac{N_2\phi_2}{i_1}}$$

Where, M = Mutual inductance

N_2 = Number of turns in another coil

ϕ_2 = Flux in another coil.

292. If H is magnetic field intensity, I is current and J is current density.

(a) $\nabla . H = J$ (b) $\nabla \times H = J$

(c) $\nabla \times \vec{H} = \vec{J}$ (d) None of these

GSSSB Electronics Instructor- 22.01.2017

Ans. (c) : If I is current and J is current density and H is magnetic field intensity then according to stokes theorem $\boxed{\nabla \times \vec{H} = \vec{J}}$

According to Ampere's law,

$$\oint \vec{H}.d\vec{l}$$

Let $\vec{J}$ be the conduction current density

$$I = \int_s \vec{J}.\vec{ds}$$

$$\oint_l \vec{H}.dl = \int_s \vec{J}.\vec{ds}$$

This is the Maxwell third equation in integral form According to Stokes theorem-

$$\oint_s \vec{A}.\vec{dl} = \int_s (\nabla \times \vec{A}).ds$$

293. The flux density is the flux divided by-

(a) Conductivity
(b) Permeability
(c) Area of cross section
(d) Area of the current carrying conductor

KPSC Instructor 16.01.2017

Ans. (c) The flux density is the flux divided by area of cross section.

$$\text{Flux density (B)} = \frac{\text{Magnetic flux}(\phi)}{\text{Area(A)}} \text{ Wb/m}^2$$

■ The SI unit of flux density is Weber per meter square or Tesla.
■ The CGS unit of flux density is Gauss.

1 Tesla = 10^4 Gauss

294. The permeability of a material means

(a) Strength of a material
(b) The conductivity of a magnetic material to the magnetic lines of force
(c) Strength of an electromagnet
(d) Magnetization remained in an iron bar on withdrawal of magnetising force

ISRO (URSC) Technician (B) 27.11.2016

Ans. (b) : The permeability of a material means the conductivity of a magnetic material to the magnetic line of force.

■ Magnetic permeability is defined as the ratio of the magnetic induction to the magnetic intensity.

$$\boxed{\mu = \frac{B}{H}}$$

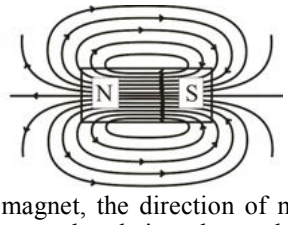
■ It is a scalar quantity.
■ The SI unit of magnetic permeability is Henry per meter (H/m).

295. Which among the following is the direction of flow of line of force around a bar magnet ?

(a) Out of the east pole into the west pole
(b) Out of the west pole into the east pole
(c) Out of the south pole into the north pole
(d) Out of the north pole into the south pole

KPSC Electrician 30-09-2020
ISRO (URSC) Technician (B) 27.11.2016

Ans. (d) : The direction of flow of line of force around a bar magnet is out from of the north pole and into the south pole.



■ Inside the magnet, the direction of magnetic line of force is from south pole into the north pole.
■ The lines of magnetic field from a bar magnet form closed lines.

296. The emf induced in a coil depends on:

(a) The number of its turns
(b) Change of flux linked with it
(c) Time taken to change the flux
(d) All of the above

ISRO (VSSC) Technician (B) 21.02.2015

Ans. (d) : The emf induced in a coil depends on:
1. The number of turns
2. Change of flux linked
3. Time taken to change the flux.

$$e = -N\frac{d\phi}{dt}$$

Faraday's second law- The flux linkage of the coil is the product of the number of turns in the coil and flux associated with the coil.

$$E = -N\frac{d\phi}{dt} \text{ volt.}$$

Faraday's first law of electromagnetic induction states that whenever a conductor is placed in a varying magnetic field, emf is induced which is called induced emf.

297. Electromotive force is provided by
(a) Resistance
(b) A conducting path
(c) An electric current
(d) An electrical supply source

DSSSB Instructor Electrician-06.10.2019
ISRO (SAC) Technician (B) 06.11.2016

Ans. (d) : Electromotive force or e.m.f is provided by a battery or cell per Coulomb of charge passing through it.
- emf is measured by volt (V).
- Electromotive force is equal to the potential difference across the terminals of the cell when no current is flowing.
- When no current flows the electromotive force (EMF) equal the terminal potential difference. Although both emf are terminal potential difference are measured in volt.

298. Which of the following is not the property of magnet?
(a) When suspended freely mo8ves to a fixed position relative to North and South pole of earth
(b) Produces magnetism in a nearby magnetic substance by induction
(c) Unlike poles repel each other and like pole attracts each other
(d) Attracts magnetic substances like iron and steel

ISRO (SAC) Ahmedabad Technician (B) 18.11.2018

Ans. (c) : Following are the properties of magnet -
- When suspended freely moves to a fixed position to north and south pole of earth.
- It produces magnetism in a nearby magnetic substance by induction.
- Unlike poles attract to each other like pole repel each other.
- Magnet attracts magnetic substance like iron and steel.

299. By which law, the direction of induced emf will be identified?

(a) Faradays first law of electromagnetic induction
(b) Faradays second law of electromagnetic induction
(c) Lenz's law
(d) Fleming's left hand rule

ISRO (SAC) Ahmedabad Technician (B) 18.11.2018

Ans. (c) : Direction of induced emf will be identified by Lenz's law.

■ This law states that the polarity of induced emf is such that it tends to produce a current which opposes the change in magnetic flux that produce it.

Mathematically, it can be expressed-

$$E = -N\frac{d\phi}{dt}$$

Where, $d\phi$ = change in magnetic flux
dt = change in time

300. A substance that has low retentiveness can be used for manufacturing of:

(a) Electromagnets
(b) Permanent magnets
(c) Diamagnets
(d) Paramagnets

ISRO (VSSC) Technician (B) 25.09.2016

Ans. (a) : A substance that has low retentiveness can be used for manufacturing of electromagnets.

Electromagnets- It is made of coils of wire with electricity passing through them moving charges create magnetic fields so when the coils of wire in an electromagnet have an electric current passing through them then coils behave like a magnet.

301. The direction of magnetic lines of force, when the current is into the plane of the paper is in:

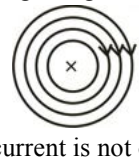
(a) Clockwise direction
(b) Anticlockwise direction
(c) In a straight line, opposite to current direction
(d) None of the above

ISRO (VSSC) Technician (B) 25.09.2016

Ans. (a) : The direction of magnetic lines of force, when the current is into the plane of the paper is in clockwise direction.

When the current is into plane of the paper-

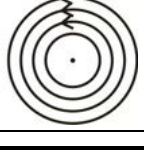
According to right hand rule.



direction of magnetic line of force is clockwise.

When current is not of the plane of the paper-

Anti clockwise



302. Two current carrying conductors laying parallel to each other are exerting a force of attraction on each other. The currents are:

(a) Low and varying

(b) High

(c) In opposite direction

(d) In the same direction

ISRO (VSSC) Technician (B) 25.09.2016

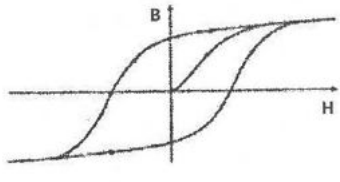
Ans. (d) : Two current carrying conductor laying parallel to each other are exerting a force of attraction on each other. The current are in the same direction.

■ The magnetic force per unit length between two parallel wires is given by

$$\frac{F}{l} = \frac{\mu_0}{2\pi} \times \frac{I_1 I_2}{d}$$

■ If the conductor carries the current in the opposite direction, then the force between them will be repulsive.

303. The famous characteristic curve below is related to_____



(a) Alternator efficiency

(b) Swing curve

(c) Electro magnetism

(d) Lightning curve

ISRO (SDSC) Technician (B) 29.04.2018, 2:30-4:00PM

Ans. (c) : The famous characteristic curve is related to electromagnetism.

→ Electromagnetism is the physical interaction among electric charges, magnetic moments and the electromagnetic field.

Hysteresis loop- The hysteresis loop shows the relationship between the magnetic flux density and the magnetizing field strength. The loop is generated by measuring the magnetic flux coming out from the ferromagnetic substance while changing the external magnetizing field.

304. A voltage of 20V is induced in a coil when the current through it changes from 10A to 20 A in 5Sec. Find out the inductance of the coil.

(a) 5H (b) 10H

(c) 40H (d) 50H

ISRO IPSC Tech-B 22.04.2018

Ans. (b) : Given, induced emf (e) = 20V
Change in current (di) = 20–10 = 10 Amp
Change in time (dt) = 5 sec
Let inductance = L Henry
Formula,

$$e = L\frac{di}{dt}$$

$$20 = L \times \frac{10}{5}$$

$$L = \frac{20 \times 5}{10} = \frac{100}{10}$$

$$\boxed{L = 10H}$$

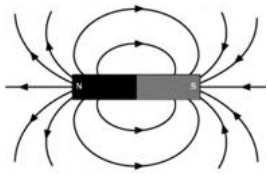
305. Energy stored in an inductance is given by

(a) $\frac{1}{2}LI^2$ (b) LI^2
(c) $2LI^2$ (d) Zit

KPSC Electrician -30.09.2020

Ans. (a) : Energy stored in an inductance is given by $\frac{1}{2}LI^2$

- This energy is stored in the magnetic field generated in the inductor due to the flow of current.

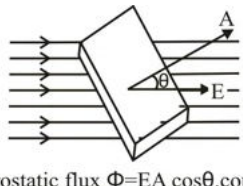


306. Unit of electro static flux density is :

(a) Farad/meter
(b) Coulomb/ m^2
(c) Weber/ m^2
(d) None of these

(DMRC Maintainer Electrician 2017)

Ans : (b) Unit of electro static flux density is coulomb per metre square.



Electrostatic flux $\Phi = EA\cos\theta$ coulombs

- Electric flux per unit area is known as electro static flux density.

$$\boxed{D = \frac{\psi}{A}}$$

When ψ is electric flux passing through area.

- Electric flux density is also known as electric displacement