Chapter 12

Q.1. What are the factors on which electric flux depends?

Ans. Mathematically expression for electric flux is given as,

$$\emptyset = E\ A\ Cos\theta$$

Thus, electric flux depends upon following factors.

(i) Magnitude of electric intensity E.
(ii) Area of the surface A.
(iii) Orientation of the area θ.

Q.2. State the Gauss's law and write its mathematical relation.

Ans. Statement of Gauss's law:

"The electric flux through any closed surface ie equal to $1/\varepsilon_o$ times total charge enclosed in It"

Mathematically, we can write Gauss's law as

$$\emptyset = 1/\varepsilon_o\ (Q)$$

Where, Ø = (Flux through closed surface)

ε_o = (Permitivity of free space)

Q = Charge enclosed by closed surface)

Q.3. Define electron volt and show that 1e V = 1.6×10^{-19} J.

Ans. Electron Volt: It is amount of energy lost or gained by electron when it is moved between two points having a potential difference of one volt. It is unit of energy which is used in atomic physics.

Proof of 1e V = 1.6×10^{-19} J

As energy acquired by a particle of charge q moving between two points having a potential difference of ΔV is given by

$$\Delta U = q\Delta V$$

In the absence of external force this change in P.E. appears in the form of change in K.E.

$$\Delta(K.E.) = q\Delta V$$

If q = e = 1.6×10^{-19} C and ΔV = 1 volt

$$\Delta(K.E.) = (1.6 \times 10^{-19}\ C)\ (1V) = (1.6 \times 10^{-19}\ )\ (C \times V) = 1.6 \times 10^{-19}\ J$$

The amount of energy is equal to 1.6×10^{-19} J is called one electron-volt and is denoted by 1eV.

Hence, 1e V = 1.6×10^{-19} J

Q.4. The time constant of a series RC circuit is t = RC. Verify that ohm times farad is equivalent to second.

Ans. The expression for time constant of a series RC circuit is given as

$$t = RC \text{----------(1)}$$

Since, $V = IR$----------(2)

Also, $I = Q / t$ put in (1)

$$V = (Q/t)\, R$$

$$R = Vt / Q\text{--------(3)}$$

Since, equation of capacitor is given as,

$$Q = CV$$

$$\Rightarrow C = Q / V\text{---------(4)}$$

Multiply (3) and (4)

$$RC = (Vt / Q)(Q / V)$$

$$RC = t$$

$$t = RC$$

Hence, ohm × farad = second

Q.5. What are the factors on which Coulomb's force between two charges depends?

Ans. Mathematical expression for Coulomb's force is given as,

$$F = 1/4\pi\, \varepsilon_o\, (Q_1 Q_2 / r^2)$$

Coulomb's force depend upon following factors

(i) Directly proportional to the product of magnitude of two charges "Q_1Q_2".
(ii) Inversely proportional to the square of distance between two charges r^2.
(iii) The medium between two charges.

Q.6. Define permittivity of free space and relative permittivity. Also give their units.

Ans. Permitivity of a medium (ε): "It is measure of how electric field OR electric force affect OR is affected by di-electric medium."

$$\varepsilon = \varepsilon_o\, \varepsilon_r$$

Permitivity of free space (ε_o): "It is measure of how electric field OR electric force affect OR is affected by free space as medium."

Relative permittivity (ε_r): OR Dielectric constant:

"It is ratio of permittivity of medium to the permittivity of free space" OR

$$\varepsilon_r = \varepsilon / \varepsilon_o$$

"It is ratio of electrostatic force between the charges in the vacuum to the force when the medium between the charges is dielectric"

Unit of permittivity is $C^2N^{-1}m^{-2}$

Q.7. Write the similarities and dissimilarities between electric force and gravitational force.

Ans. Similarities between electric and gravitational force:

(i) Both forces are conservative forces. It means the work done in gravitational and electric forces is independent of the path followed by the body.
(ii) Both forces are inverse square forces. It means these are inversely proportional to the square of distance.
(iii) Both forces are mutual forces.

Dissimilarities between electric and gravitational force:

(i) The value of gravitational constant ($G = 6.67 \times 10^{-11}\ Nm^2Kg^{-2}$) is very small as compared to electric constant ($k = 9 \times 10^9\ Nm^2C^{-2}$) is large. It means gravitational force is very small as compared to electric force.
(ii) Gravitational force is attractive whereas electric force can be attractive or repulsive.
(iii) The electric force depends in medium and can be shielded, whereas gravitational force does not have this property.

Q.8. Draw a graph for charging and discharging of a capacitor in case of RC circuit.

Ans. See Fig. 12.28 (a) and Fig. 12.29 (b)

Q.9. Define the time constant of a capacitor.

Ans. Time Constant: It is time required by the capacitor to deposit 0.63 times the equilibrium charge.

Time constant of a capacitor shows how fast or slow a capacitor is charging or discharging.

It depends on the product of resistance R and capacitance C used in the circuit. As the unit of product RC is that of time, so this product is known as Time Constant.

Q.10. Write any two characteristics of electric field lines.

Ans. Two characteristics of electric field lines are:

(i) Electric field lines originate from positive charges and end on negative charges.
(ii) The lines are closer where the field is strong and the lines are farther apart where the field is weak.

Q.11. Define electric polarization and electric dipole.

Ans. Electric polarization: The process in which the molecules of a dielectric becomes dipoles under the action of electric field is called electric polarization.

Electric dipole: Two equal and opposite charges separated by a small distance are said to constitute a dipole.

Q.12. Define potential gradient and give its S.I. units.

Ans. Potential Gradient: The quantity which gives the maximum value of rate of change of potential with distance is known as potential gradient.

$$\text{Potential Gradient} = \Delta V / \Delta r$$

It may be noted that the electric intensity is equal to the negative of the gradient of potential. That is, $E = -(\Delta V / \Delta r)$

The unit of potential gradient is volt per meter (V / m).

Q.13. Prove that Coulomb's law obeys third law of motion.

Ans. Coulomb's law obeys third law of motion. Because Coulomb's force is a mutual force.

As, $\mathbf{F_{21}}$ = Force on charge q_2 due to charge $q_1 = k\,(q_1q_2 / r^2)\,\mathbf{r_{21}}$

Where, $\mathbf{r_{21}}$ = Unit vector directed from q_1 to q_2, $\quad k = 1 / 4\pi\varepsilon_o$

$$\mathbf{F_{21}} = k\,(q_1q_2 / r^2)\,\mathbf{r_{21}}$$

$$\mathbf{F_{21}} = k\,(q_1q_2 / r^2)\,(-\mathbf{r_{12}}), \qquad \mathbf{r_{21}} = -\mathbf{r_{12}}$$

Where, $\mathbf{r_{12}}$ = Unit vector directed from q_2 to q_1

$$\mathbf{F_{21}} = -k\,(q_1q_2 / r^2)\,(\mathbf{r_{12}}) = \mathbf{F_{12}}$$

Where, $\mathbf{F_{12}}$ = Force on charge q_1 due to charge q_2

Hence, $\mathbf{F_{21}} = -\mathbf{F_{12}}$

i.e., if q_1 exerts a force on q_2 then q_2 also exerts an equal and opposite force on q_1

Q.14. Show that $V\ m^{-1} = N\ C^{-1}$ are equivalent units for electric field intensity.

Ans. $V\ m^{-1} = N\ C^{-1}$

L-H-S $= V\ m^{-1}$

$= V / m$

$= (J / C) / m \qquad (v = w/q)$

$= J / C\text{-}m$

$= (N\text{-}m) / (C\text{-}m) \qquad (w = fd)$

$= (N / C)$

$= NC^{-1}$

= R-H-S

Hence, $V\ m^{-1} = N\ C^{-1}$ OR (volt) / (meter) = (newton) / (coulomb)

Q.15. Define surface charge density.

Ans. Surface Charge density: It is defined as charge per unit area of a surface. It is denoted by symbol "σ"

Mathematically, $\sigma = Q / A$

Where, Q = (Amount of charge)

A = (Area of surface)

SI unit of σ is C / m^2 or Cm^{-2}

Chapter 13

Q.1. Define electrolysis and state the basic principle of electroplating.

Ans. Electrolysis: Certain liquids such as dilute sulphuric acid and copper sulphate solution conduct electricity due to some chemical reactions that takes place within them. The study of this process is known as electrolysis.

Electroplating is a process of coating a thin layer of some expensive metal (gold, silver) on an article of some cheap metal. The basic principle of electroplating is based on Electrolysis.

Q.2. List and briefly explain four kinds of current sources.

Ans. Four kinds of current sources are:

(i) Cells(primary or secondary): They convert chemical energy into electrical energy.
(ii) Electric Generators: They convert mechanical energy into electrical energy.
(iii) Thermo-couples: They convert heat energy into electrical energy.
(iv) Solar cells: They convert sunlight directly into electrical energy.

Q.3. What is a voltameter? Define its two electrodes.

Ans. Voltameter: The vessel containing two electrodes and an electrolyte is called voltameter.

The two electrodes of voltameter are:

Anode: The electrode connected with the positive terminal of the current source is called anode.

Cathode: The electrode connected with the positive terminal of the current source is called cathode.

Q.4. Define ohmic and non-ohmic devices and give examples.

Ans. Ohmic Devices: The devices which strictly obey Ohm's law are called Ohmic devices.

For example, Eureka wire, carbon resistors etc

Non- Ohmic Devices: The devices which do not obey Ohm's law are called Ohmic devices.

For example, Filament bulbs, semi-conductor diode etc.

Q.5. What is thermistor? Give its applications.

Ans. Thermister: A thermistor is a heat sensitive resistance. OR It is a resistor whose resistance changes with temperature of its surroundings.

Applications: Thermistors have wide applications as temperature sensors. i.e., they convert changes of temperature into electrical voltage which is duly processed.

Q.6. Define electronic current and conventional current.

Ans. Electronic Current: The current due to flow of negative charges (electrons) is called electronic current. It flows from negative terminal to positive terminal of battery through the circuit.

Conventional Current: The current which passes from a point at higher potential to a point at a lower potential as it represented a movement of positive charges. It flows from positive terminal to negative terminal of battery through the circuit.

Q.7. Briefly explain Kirchhoff's second rule for and electric circuit.

Ans. Kirchhoff's second rule: This rule states that "The algebraic sum of voltage OR potential changes in a closed circuit or loop is zero."

This rule is simply a particular way of stating the law of conservation of energy in electrical problems. This rule is used to analyse the complex networks.

Q.8. Distinguish between resistivity and conductivity.

Ans. Resistivity: Resistivity of a substance is defined as "resistance of a meter cube of the wire (material)". It is denoted by ρ. Mathematically, it can be written as

$$\rho = R (A / L)$$

Where, L is the length of wire, A is cross-sectional area and R is its resistance.

The SI units of resistivity are ohm-meter OR (Ωm).

Conductivity: The reciprocal of resistivity is called conductivity.

$$\text{Conductivity} = 1 / \text{Resistivity}$$

It is denoted by σ, So, $\sigma = 1 / \rho$

The SI units of conductivity are $ohm^{-1}m^{-1}$ OR mho m^{-1}

Q.9. What is potentiometer? Give its two uses.

Ans. Potentiometer: A very simple instrument which can measure and compare potential differences accurately without drawing any current from the circuit/cell.

Uses of potentiometer: Following are two uses of potentiometer.

(i) To find unknown EMF of a cell.
(ii) Two compare EMF of two cells.

Q.10. What is meant by tolerance? Find the resistance of a resistor with red, green, orange and gold respective bands.

Ans. Tolerance: It is defined as possible variation of a resistance from the marked/given value.

For Gold tolerance is 5%

For Silver tolerance is 10%

When no fourth band, then tolerance is 20%

For resistance of given resistor

First band = Red = 2

Second band = Green = 5

Third band = Orange = 3

Fourth band = Gold = 5% tolerance

Thus numerical value of resistance is 25000Ω ± 5%

Q. 11. Write two uses of rheostat and draw their diagrams.

Ans. Two uses of rheostat are:

(i) It is used as a variable resistor.
(ii) It is used as a potential divider.

For diagrams see fig. 13.13 & Fig. 13.14

Q. 12. Define temperature coefficient of resistance and write its formula and units.

Ans. Temperature Coefficient: "The fractional change in resistance per kelvin is known as the temperature coefficient". It is denoted by α

Mathematically, $\alpha = (R_t - R_o) / R_o\, t$

Where, R_o = (Resistance of conductor at 0°C), R_t = (Resistance of conductor at t°C)

t = (Change in temperature)

Units of α is K^{-1} or per kelvin

Chapter 14

Q. 1. How can the sensitivity of a galvanometer be increased?

Ans. Sensitivity of galvanometer is defined as the current in micro ampere required to consume one millimeter deflection on a scale placed 1 m away from the mirror.

As

$$\mathbf{I = c\theta / BAN}$$

By using strong magnetic field around the coil, the sensitivity of a galvanometer can be increased.

Q. 2. What are the factors on which the force on a current carrying conductor in a magnetic field depends upon?

Ans. Magnetic force experience by a current carrying conductor placed in a magnetic field is:

$$\mathbf{F = BIL \sin\theta}$$

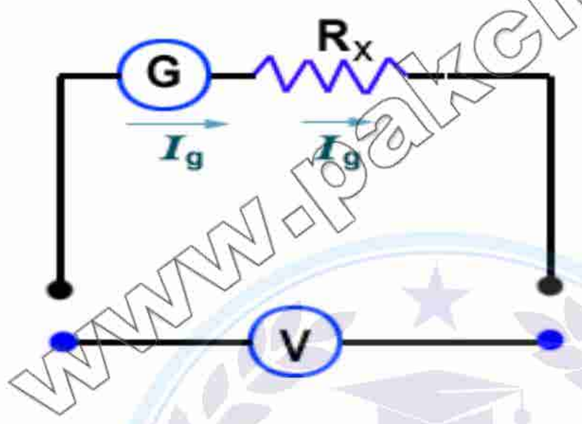
The factors on which the force on a current carrying conductor depends:

i. Strength of magnetic field (B)
ii. Current passing through the conductor (I)
iii. Length of the conductor (L)
iv. Orientation of the conductor in magnetic field (θ)

Q. 3. How can you convert a galvanometer into voltmeter?

Ans. If we want to convert a galvanometer in to voltmeter, a high resistance will always used in series with galvanometer.

(High Resistance used in series) $\mathbf{R_h = V/I_g - R_g}$



Q. 4. Define the permeability of free space and gives its units.

Ans. The permeability of free space, μ_0, is a physical constant used often in electromagnetism. It is value of $4\pi \times 10^{-7}$ Wb / A m. It is connected to the energy stored in a magnetic field. Its units are weber per ampere meter (Wb / A m)

Q. 5. What is digital multimeter? Gives its two advantages over AVO.

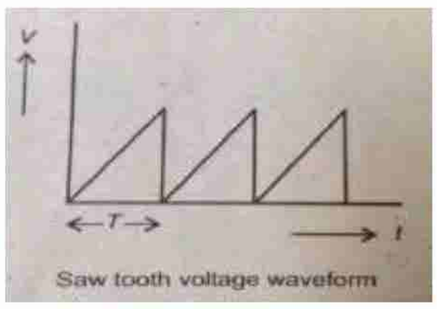
Ans. A digital multimeter is a test tool used to measure two or more electrical values—principally voltage (volts), current (amps) and resistance (ohms).

Advantages:

i. It offers automatic output display.
ii. It ensures accuracy.

Q. 6. Draw saw tooth voltage waveform and explain it.

Ans. The voltage that is applied across the horizontal (x) plates is usually provided by a circuit that is built in the CRO. It is known as sweep or time base generator. Its output waveform is a saw tooth voltage of period T. The voltage increases linearly with time for a period T and then drops to zero as shown in figure.



Saw tooth voltage waveform

Q. 7. Define (i) tesla and (ii) weber

Ans. Tesla:
S. I. Units of magnetic induction is called "tesla". The strength of magnetic field will be one tesla (T) if a force of one newton acting on one meter length of the conductor placed at right angle to the magnetic field when 1 A current is passing through it.
Weber:
S. I. unit of magnetic flux is weber (wb)

Q.8. What is a dead beat galvanometer and why is it more desirable?
Ans. A galvanometer in which the coil comes to rest quickly after the current passed through it or the current is stopped from flowing through it, is called stable or a dead beat galvanometer. A dead beat galvanometer is a galvanometer that has been damped so that its oscillation die away very quickly. It is used to determine the current, mostly used during experiments.

Q. 9. Is it possible to obtain an isolated north pole? Give reasons.
Ans. Magnetic mono-pole does not exist, because magnetic field lines always forms a close loop. If it arises from one pole, then it has to terminate on other one, to form close loops, which is opposite pole, hence due to this property magnets always found in dipole.

Q. 10. What is CRO? Write the name of any four parts of it.
Ans. A high speed graph plotting electronic instrument is called cathode ray oscilloscope (CRO).
Main Parts:

i. electron gun
ii. grid
iii. fluorescent screen
iv. horizontal and vertical deflecting plates
v. Anodes

Q.11. List the uses of CRO.
Ans. Main uses of CRO:

i. it is used for displaying the wave form of a given voltage.
ii. the instantaneous and peak value of the voltage can easily measured.
iii. Time period and frequency of the voltage can be measured.
iv. Phase difference between two voltages can be measured.

Q. 12. What is Lorentz force? Write it in mathematical expression.

Ans. Lorentz force: The vector sum of electric and magnetic force acting on a charged particle moving in an electric and magnetic field is called Lorentz force.

Mathematical expression:

$$\mathbf{F_L = F_E + F_B}$$

$$\mathbf{F}_L = q\,\mathbf{E} + q\,(\mathbf{v} \times \mathbf{B})$$

Q.14. State Ampere's law and write its mathematical form.
Ans. Statement:
"Ampere's law states that for any closed loop path, the sum of the length elements times the magnetic field in the direction of the length element is equal to the permeability times the electric current enclosed in the loop".
Mathematical form:

$$\sum_{r=1}^{n} (\mathbf{B}.\Delta\mathbf{L})_r = \mu_o I$$

Q.13. Define electromagnetism and give the name of one device in which electromagnetism is used.

Ans. Electromagnetism:

The physics of electricity and magnetism. An interaction between electricity and magnetism, as when an electric current or a changing electric field generates a magnetic field, or when a changing magnetic field generates an electric field is called electromagnetism.

Magnetic levitation train:

This is the modern technology of transportation systems that use the concept of electromagnetism. These are called as high speed trains which use powerful electromagnets to develop the speed.

Chapter 15

Q.1. What are the dimensions of mutual inductance?

Ans. The dimensional formula for mutual inductance $M = [ML^2T^{-2}A^{-2}]$

Q.2. If number of turns in a solenoid is doubled, keeping the other factors constant, does self-inductance change?

Ans. Given, **number of turns** of **solenoid** is double **keeping** all **other factors** constant. Coefficient of **self induction** is given by, therefore, **when number of turns** is **doubled**; the coefficient of **self induction** will increase 4 times of its initial value.

Q.3. How can induced current be increase?

Ans. 1). Speed of conductor (v)

2) Number of turns of the coil(N)

3) Strength of magnetic field (B)

Q.4. What is motional emf. Write its mathematical relation.

Ans. The emf induced by the motion of a conductor across the magnetic field is called motional emf.

Mathematically

$$e=-VBLSin0$$

Q.5. Distinguish between slip rings and split rings.

Ans. A split ring commentator makes the current change direction every half rotation where's the slip ring commentator merely maintains a connection between the moving rotor and stationary stator.

Q.6. State the Lenz's law and define hennery.

Ans. Statement: "It states that the direction of induce current is always so as to oppose the change which causes the current".

Henry: "The mutual inductance of the pair of coil in which a rate of change of current of 1 ampere per second in the primary causes on induce emf of 1 volt in the secondary coil".

Q.7. Why transformers are used in AC Supply Network?

Ans. transformer can only be used for AC supply because as it is sinusoidal change, en magnitude will be there due to which flux will also be change, we know rate of change of flux is directly proportional to emf produced. Hence emf generate winding and transformer will work more efficient.

Q. 8. What is back motor effect in generators? Explain.

Ans. When two forces acting on the coil, force F1 acting on left side and F2 opposite force acting on right side of the coil. The force produce anti-clock wise torque bad opposes the rotational motion of the coil, this effect is called back motor fact in generator.

Q. 9. State Faraday's law and write it in mathematical form.

Ans. Statement:

The induced emf in a coil is directly proportional to the negative time rate of change of magnetic flux through the coil.

Mathematical formula:

Electromagnetic induction, when a coil has N terms the induced emf.

$€= -N\Delta\Phi/\Delta t$

Q. 10. List the factor on which mutual inductance depends.

Ans. It depends on the following factors:

1. Number of terms in the coil.
2. Area of cross section of the coils.
3. Distance between the two coils.
4. Nature and core material upon which the two coils we worked.

Q. 11. Define self-inductance and self-induction.

Ans. Self-induction:

The phenomenon in which a charging current in a coil induces an emf in itself is called self-induction.

Self- inductance:

The ratio of average enf in the coil to the time rate of change of current in the same coil.

Q. 12. Give the two techniques to improve the efficiency of a transformer.

Ans. 1**. Insulations:** The insulation between sheets and core should be perfect to stop eddy currents.

2**. Resistance of primary and secondary coils**: Since power transfer from primary to secondary coil takes place through flux linkages, so the primary and secondary coils should be wound in such a way that flux coupling between them is maximum.

Chapter 16

Q.1. Define resonance frequency? Give its equation.
Ans. In a circuit when the inductive reactance becomes equal to the capacitive reactance i.e $X_L=X_C$. At this point the frequency is called resonance frequency.

Q.2. Define chock? Give its uses.
Ans. It consists of an inductive coil and is used to adjust the current in Ac circuits. It plays the same part in AC circuits to resist in DC circuits for many purposes. It is used to reduce to current in given AC circuits without small wastage of energy when supply voltage is constant.

Q.4. How does the voltage output of a generator change with its angular velocity?
Ans. The output V of AC generator at any instant is $V=V_o \text{ Sin } 2\pi/T$.
When; t=0 then V=0

t=T/4 then $V=V_o$

t= T/2 then V=0

t=3T/4 then $V=-V_o$

t=T then V=0

Q.5. With reference to modulation, give the difference b/w information and carrier?
Ans. In modulation the carries is a high frequency radio wave and information is a low frequency signal. The low frequency signal is known as modulation signal. Modulation is received by changing amplitude or frequency of the carrier wave in accordance with modulated signal.

Q.6. What is a chock coil and why it is used in AC circuit?
Ans. It is a coil of thick copper wire wound closely in a large number of turns over a soft iron. It is used in AC circuits to limit current with extremely small energy as compared to resistance of the rheostat.

Q.7. How much energy is consumed by a chock when an AC is passed through its? Explain.
Ans. Choke makes the inductance L of the coil quite large whereas the reactance R is very small. Thus it consumes extremely small power. It is used in AC circuits to limit current with extremely small wastage of energy as compared to resistor or rheostat.

Q.8. Define impedance of a circuit and give its unit?
Ans. The opposition offered by the inductive coil to flow of AC is called inductive reactance. It is denoted by X_L. Its units are ohm.

Q.9. Define reactance? Describe the condition which will make the resistance small.
Ans. The opposition offered by the inductor and capacitor in the flow of current is called their reactance.
Conditions:

A. For capacitor reactance can be smaller by increasing frequency.
B. For inductor reactance can be made smaller by decreasing frequency.

Q.10. Differentiate b/w single phase and three phase AC supply?
Ans. Single Phase: 1. Total load is not divided. 2. It cannot operate heavy machinery.

Three Phase: 1. Total load is divided into three parts. 2. It can operate heavy machinery which need 400V.

Q.11. What is modulation? Name its types.
Ans. Modulation is a process of combining low frequency signal with a high frequency radio wave. Resultant wave is called modulated carrier wave. The low frequency signal is called modulation signal.

Q.12. What is an inductor?
Ans. A device which do not allow the AC current to pass through it.

Q.13. When a 50 V is applied to an AC circuit the current flowing through it is 50 mA. Find the impedance?
Ans. V=50V

I= 50Ma

$Z=V/I = 50/50x10^{-3}$

$Z= 1x10^{3}$ ohm.

Q.14. Differentiate b/w peak value and peak to peak value?
Ans. The maximum value of voltage or current on either side is called peak value. It is denoted by V_P. The sum of negative or positive peak values is called p-p value.

Q.15. What is the main reason for the worldwide use of AC?
Ans. The main reason for the worldwide use of AC is that it can be transmitted to long distance easily and at a very low cost.

Q.16. What is meant by phase difference?

Ans. The instantaneous value of alternating voltage is given by.

$V=V_O Sin\theta$

This angle ɵ hich specifies the instantaneous value of voltage or current is known as phase.

Q.17. Which quantity, voltage or current leads in a capacitor and by how much angle?
Ans. The current is leading and voltage is lagging by an angle of 90^0.

Q.18. Define reactance of an inductor and write its formula?
Ans. The opposition offered by the inductive coil to flow of AC is called inductive reactance. It is denoted by X_L. Its units are ohm. $X_L=2\pi fL$

Q.19. Write two properties of R-L-C series circuit?
Ans. 1. The impendence of circuit at resonance in minimum and it is equal to R.

2. The impendence of the circuit at resonance is resistive, so the voltage and current are in phase. The power factor is 1.

Q.20. What is meant by A.M? Explain.
Ans. A type of modulation in which amplitude of the carrier wave is increased or decreased as the amplitude of the superposing modulating signal increased or decreased. The AM transmission frequency is 540 KHz to 1600 KHz.

Q.21. Write down advantages and disadvantages of A.M and F.M?
Ans.

1. The coverage area of A.M receiver is wider than F.M because of atmospheric propagation.
2. A.M is long distance propagation.
3. A.M circuit is cheaper and non-complex.
4. F.M is low noise than A.M.

Q.22. Differentiate b/w AC circuit and DC circuit?
Ans. In AC circuits in addition to resistor R, two new circuit elements are introduced inductor and capacitor. The voltage and current is controlled by the three elements RLC. The basic circuit element in DC is resistor which controls the voltage and current. The relationship is V=IR.

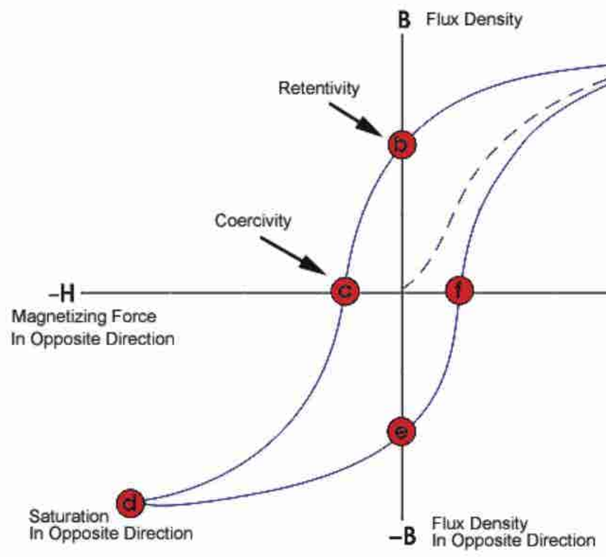
Q.23. Define power factor?
Ans. It is defined as the ratio of the power consumed in an AC to the power applied to the circuit.

Q.24. Why power is dissipated zero in pure inductive and pure capacitive circuit?
Ans. The power dissipation in a pure inductive and capacitive circuit is zero. In these cases the current lags or leads to the applied voltage by 90^0 and the component of applied voltage and vector and the current vector is zero.

Chapter 17

Q. 1. What is meant by Hysteresis Loss?

Ans. Hysteresis loss: This loss is due to repeated magnetization and demagnetization of core due to flow of alternative current. .



Reduction in loss: This loss can be reduce by soft iron core.

Q.2. What are ferromagnetic and dia-magnetic substances?

Ans. Dia-magnetic substances: The substances in which magnetic fields produced by the orbital and spin motion of electrons cancel each other and there is no permanent magnetic motion between the atoms are called diamagnetic substances e.g. copper (Cu), bismiths (Bi), antimony (Sb) etc.

Ferromagnetic substances: The substance in which the atoms co-prate with each other in such a way so that they exhibit a strong magnetic effect and are strongly attracted by magnetic field are called ferromagnetic substances e.g. iron (Fe), nickel (Ni), cobalt (Co), chromium dioxide and alnico (an iron aluminum-nickel-cobalt alloy) etc.

Q.3. What are super –conductor?

Ans. Conductors: Conductors are those materials in which we have large numbers of free electrons. They have:

- A partially filled conducted band
- A partially filled valance band
- No energy gap

Q. 4. Define unit cell?

Ans. Unit cell: The smallest three dimensional basic structure is called unit cell.

Q.5. Distinguish a donor atom from acceptor atom?

Ans. The semi-conductor which is formed by adding pentavalent impurity to a pure semi-conductor is called N-type semiconductors. Since pentavalent impurity donates a free electron, so it is called **donor impurity**, which is thermally excited into the conduction band.

Q.6. Describe briefly about the formation of energy bands in semi-conductor?

Ans. Electron of an isolated atom are bound to the nucleus and can only have definite energy level but when two atoms are bought near to each other than each level is split up into two sub level called states under the action of force exerted by other atom in solid. The closer the atom the greater will be the splitting.

These permissible energy states are discrete and closely spaced and they appear to form a continuous energy band. In between two permissible energy bands there is a range of energy bands which cannot be occupied by electron. These are called forbidden energy states and the range between two consecutive permissible energy bands is called **forbidden energy gap**.

Q.7. Define stress and strain and give their SI unit?

Ans. Stress: The force applied on unit area to produce any change in length volume and shape of a body is called stress. Its SI unit N/m^2 or Pascal.

Stain: Stain is the measure of deformation of solid material when stress is applied. It has no units because it is ratio of same quantities.

Q.8. What are the glassy solids? Do you possess property of flow?

Ans. Glassy solids: Ordinary glass which is solid at ordinary temperature, has no regular arrangement of molecules. On heating, it gradually soften into paste like state before becomes a very viscous liquid at almost **800°C.** Thus amorphous solids are called **glassy solids**. Such type of solids have no definite **melting point**.

Q. 9. What is coercivity of material ?

Ans. Coercivity: The reverse magnetizing field is required to demagnetize the material completely. The value of magnetizing current which make magnetization zero is called coercivity it is represented by C. one the material is magnetized, its magnetization curve never pass through origin, instead it forms a closed loop ACDCA, which is called hysteresis loop.

Q.10. Differentiate between ductile and brittle substance. Give an Example of each?

Ans. Ductile substances: Substances which undergo plastic deformation until they break are called ductile substances e.g. lead, copper etc.

Brittle substances: Substances which break just after the elastic limit is reached, are called brittle substances e.g. glass, high carbon steel etc.

Q.11. Distinguish b/w elasticity and plasticity?

Ans. Elasticity: The ability of a body to return to its original shape when the stress is removed is called elasticity.

Plasticity: If the stress is increased beyond yield stress or elastic limit or material, the specimen becomes permanently changed and does not reach original shape or dimension after stress is removed this kind of behavior is called plasticity. This region is represented by portion of curve from B to C.

Q. 12. Explain what Curie temperature is?

Ans. Curie temperature: The temperature above which a ferromagnetic substances becomes paramagnetic, is called Curie temperature. The Curie temperature for iron is about **750°C**.

Q.13. What does area of hysteresis loop tell?

Ans. The area of loop is proportional to energy required to take unit volume of material round one cycle of magnetization. This energy increases the internal energy of the specimen. It is called hysteresis loss and is important when material is subjected to alternating field which take them through many cycles of magnetization per second. For hard magnetic materials, the area of loop is large as compared to soft magnetic materials. So energy dissipated per second for iron is less than for steel.

Q.14. Define Modulus of Elasticity?

Ans. Modulus of elasticity: Hook's law can be stated as: within elastic limit, stress is directly proportional to strain. Mathematically

$$constant = \frac{stress}{strain}$$

Q.15. Explain briefly insulator on the basic energy band theory?

Ans. Insulators: Insulators are those materials in which the valance electrons are bound very tightly to their atoms. They have:

- An empty conduction band.
- A filled valance band.
- A large energy gap of several eV.

Q.16. Define (a) conductor band (b) valence band.

Ans. The electron in the outer most orbit are called valance electron. The band occupied by these electrons is called valance band. It is highest occupied band it may either be completely or partially filled but can never be empty. The band above the valance band is called **conductive band.** It occupied by free electron. Since they play the main role in conduction. So they are also called conduction electrons. The conduction band may be either empty or partially filled.

Q. 17. Draw the figure showing electrical conductor by holes in a semi-conductor?

Ans. Super conductors: The materials, whose resistivity approaches to zero below a certain temperature, are called **super-conductors**. These materials have zero resistivity below a certain temperature to called **critical temperature.**

Q.18. Define (a) superconductor (b) critical temperature.

Ans. Super conductors: The materials, whose resistivity approaches to zero below a certain temperature, are called **super-conductors**. These materials have zero resistivity below a certain temperature to called **critical temperature.**

Q.19. Differentiate between critical temperature and Curie temperature?

Ans. These materials have zero resistivity below a certain temperature to called **critical temperature.** The temperature above which a ferromagnetic substances becomes paramagnetic, is called **Curie temperature.** The Curie temperature for iron is about **750°C**.

Q.20. Differentiate b/w proportional limit and elastic limit?

Ans. Proportional limit: Initially, stress increased linearly with strain till it reaches at A on the curve. This point is known as proportional limit σ_p it can be define as, the greatest the stress that a material can endure without losing straight line proportionality between stress and strain is called **proportional limit**.

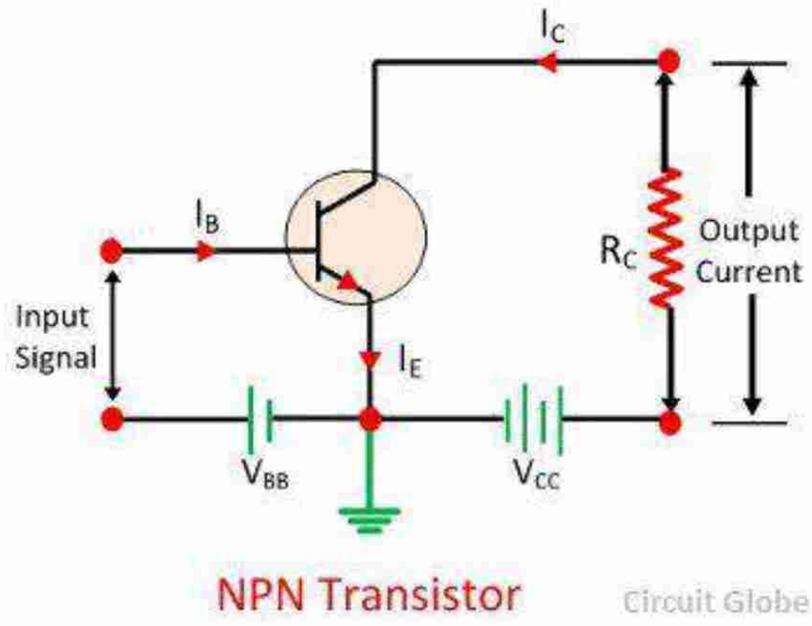
Elastic limit: Stress and strain are not proportional, but nevertheless the load is removed at any point between O and B the curve will be retraced and material will return to its own lengthy. In the region OB, the material is said to be elastic. The point B is called the yield point. The value of stress at B is known as elastic limit σ_e.

Chapter 18

Q.1. What is a transistor? How n-p-n transistor circuit is drawn in a common emitter configuration?

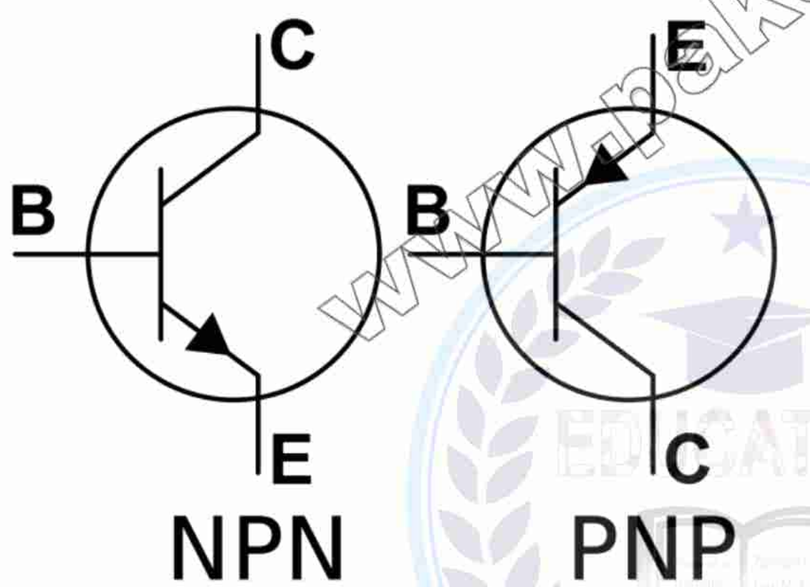
Ans. it is a single crystal of Ge and Si which can regulate current or voltage flow and acts as a switch or gate for electronic signals.

Following is the circuit to use an n-p-n transistor as common emitter,



Q.2. Draw a circuit symbol for n-pn & p-n-p transistor?

Ans. Circuit symbol for n-p-n and p-n-p transistor is given below



Q.3. Give four applications of a photodiode?

Ans. The photo diode has the following applications

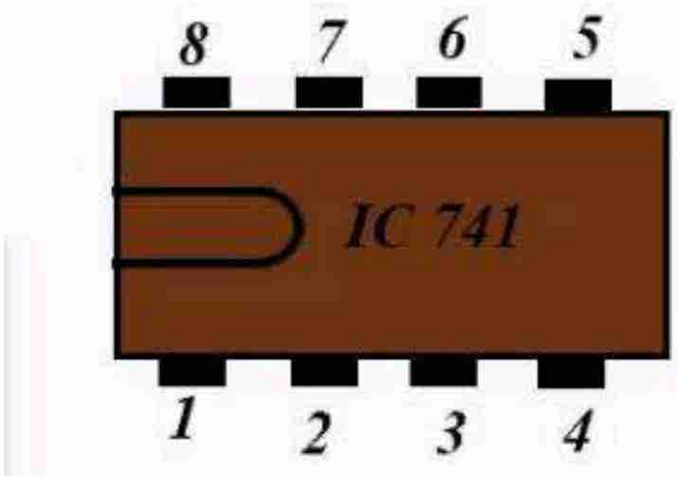
i. It can be used for automatic switching.
ii. It is used in optical fiber receivers.
iii. It is used in logic circuits.
iv. It is used in optical communication equipment.

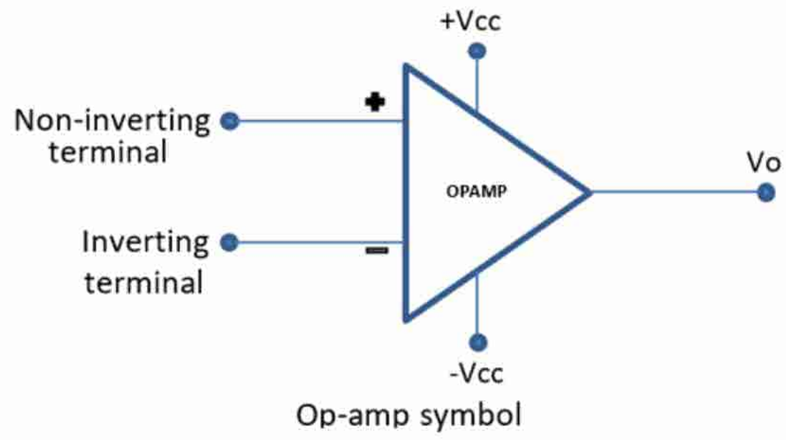
Q.4. What is potential barrier? What is the value of potential barrier for se and Ge?

Ans. Potential barrier: A potential difference is set up across the depletion region, due to charge on the ions which stops the further diffusion of charge carriers. This potential difference is called potential barrier. Its value is 0.7V for Si and 0.3V for Ge.

Q.5. What is an op-amplifier?

Ans. Op-Amplifier: The amplifier circuit integrated on a small silicon chip enclosed in a capsule is called operational amplifier.



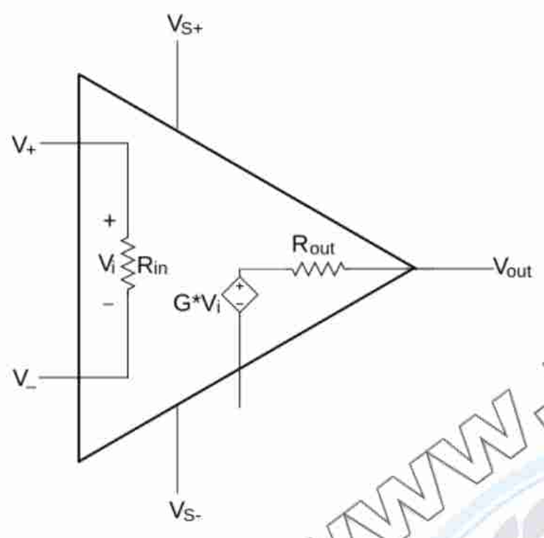


Op-amp symbol

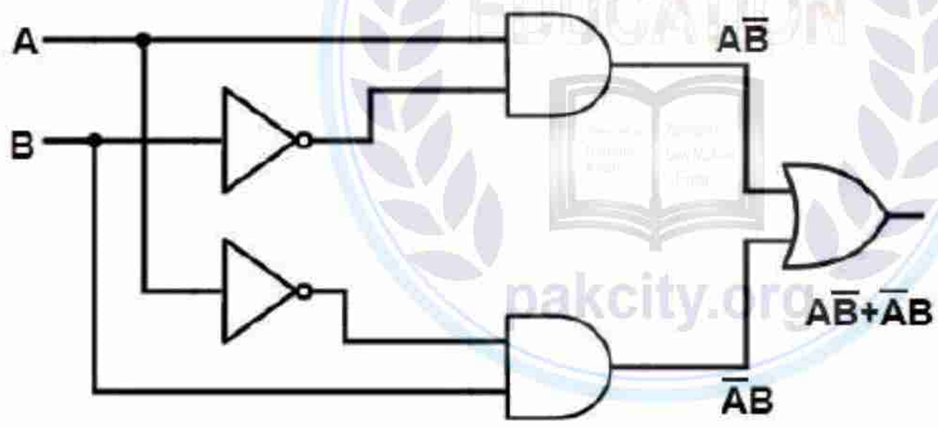
Q.6. Give any two characteristics of op operational amplifier?
Ans. Two characteristics are given below,

Input resistance: The electrical resistance between inverting (-) and no-inverting (+) input terminals is called input resistance. Its value is very high.

Output resistance: The electrical resistance between output terminal and the ground terminal is called output resistance.

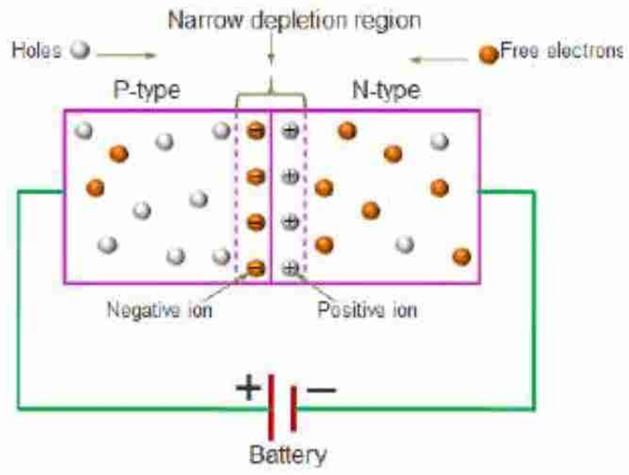


Q.7. Draw a diagram of exclusive OR gate?
Ans. Exclusive OR Gate:



Q.8. What is meant by forward biased pn-junction?

Ans. P-N junction will be forward biased if p-type substance is connected with positive terminal and n-type with the negative terminal of battery.



Forward bias

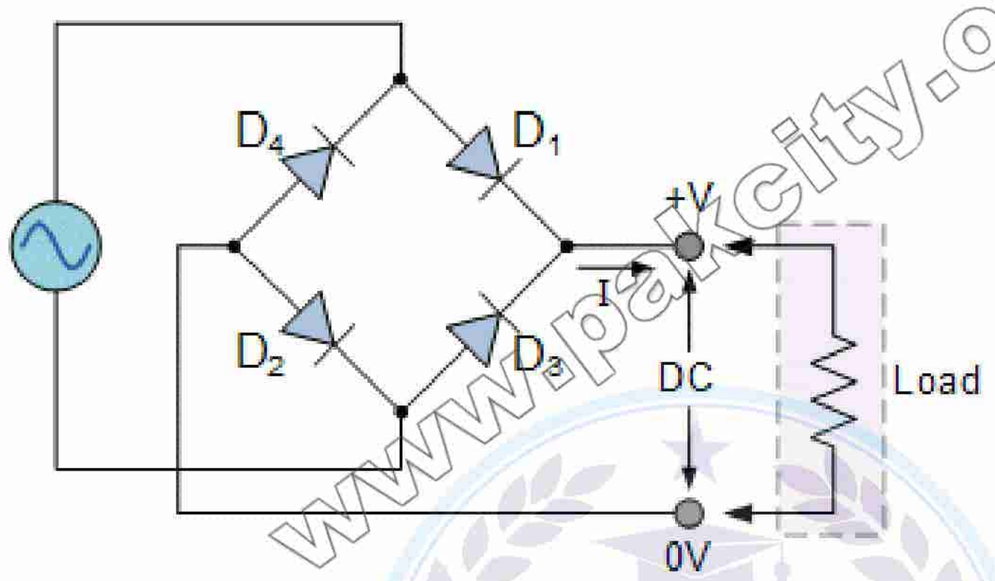
Q.9. What is photocell? Write its four uses.

Ans. A device which converts light energy into electrical energy is called photocell. Photocell is:

i. used in automatic lights that turns on and off according to night and day.
ii. used as timers to measure speed of runners during a race.
iii. used as sensors that detects when a flash light is on or sun is out.
iv. used in burglar alarm.

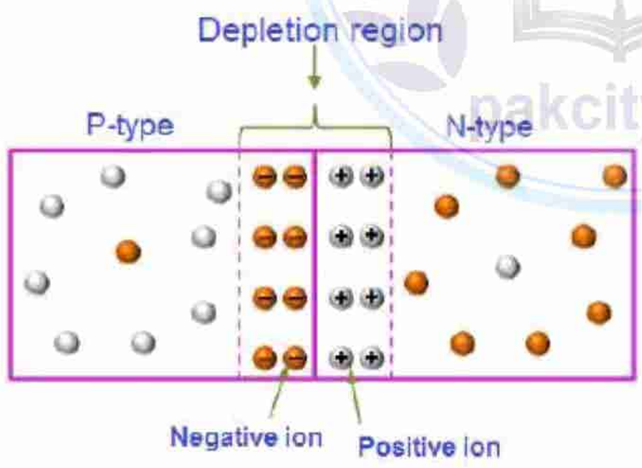
Q.10. Draw a circuit diagram of a full wave rectification.

Ans. Circuit diagram of full-wave rectification is given below,



Q.11. Define depletion region and potential barrier?

Ans. Depletion region: Depletion region or depletion layer is a region in P-N junction diode where no mobile charge carriers are present. Depletion layer acts like a barrier.



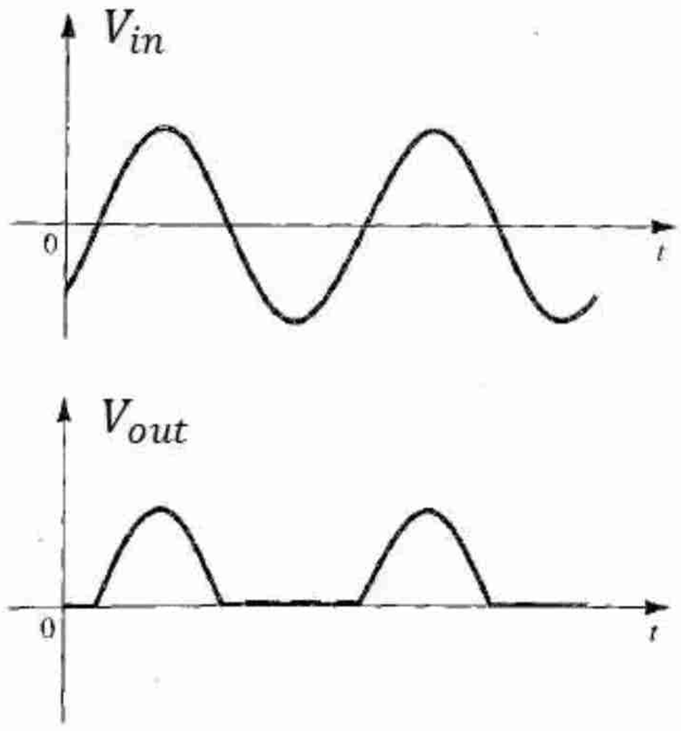
Potential barrier: A potential difference is set up across the depletion region, due to charge on the ions which stops the further diffusion of charge carriers. This potential difference is called potential barrier. Its value is 0.7V for Si and 0.3V for Ge.

Q.12. How will you obtain N-type and P-type material from pure silicon?

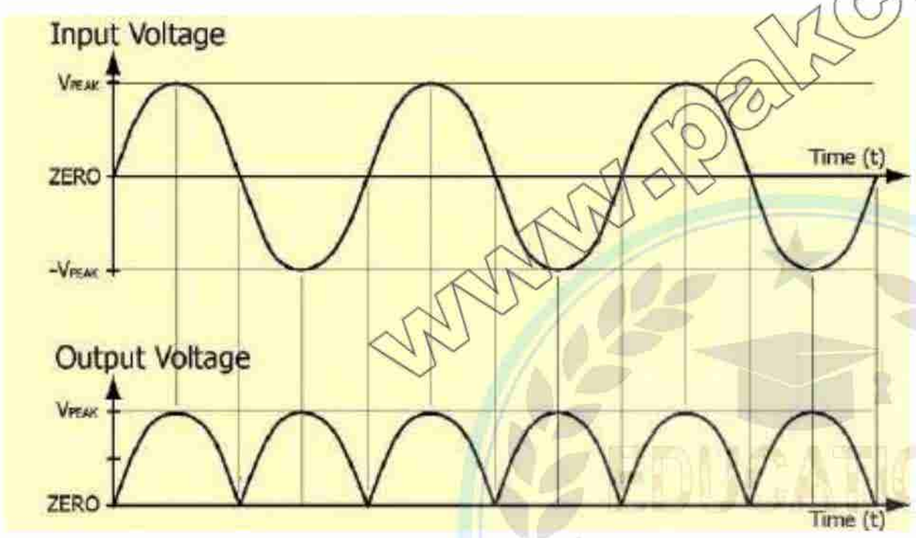
Ans. N-type material: When pentavalent element e.g, antimony, arsenic or phosphorous etc, is added to pure silicon or germanium then n-type material is formed.

P-type material: When trivalent element e.g, aluminium, boron, gallium or indium etc, is added to pure Si or Ge then p-type material is formed.

Q.13. Draw input and output wave forms of half wave and full wave rectifier.
Ans. Half-wave rectifier



Full-wave rectifier



Q.14. Define β from transistor. Also write its fundamental current unit?
Ans. In transistor, the ratio of collector current I_C to base current I_B is nearly constant. This ratio is called as β (current gain) of transistor.

$$\beta = I_C / I_B$$

It has no unit as it is the ratio of two currents.

Q.15. Define open loop gain of an operational amplifier? Also give its formula.
Ans. Open loop gain: It is the ratio of output voltage V_0 to the voltage difference between non-inverting and inverting inputs when there is no external connection between the output and the inputs.

$$A_{OL} = V_o / V_+ - V_- = V_o / V_i$$

Q.16. Write some important uses of operational amplifier?
Ans. Operational amplifier can be used:

i. as inverting and non-inverting amplifier
ii. as comparator
iii. In night switches

Q.17. What is the mathematical expression of AND gate? Write its truth table.
Ans. The mathematical expression of AND gate is given below,

$$X = A \cdot B$$

Truth table of AND Gate

Input		Output
A	B	F = A.B
0	0	0
0	1	0
1	0	0
1	1	1

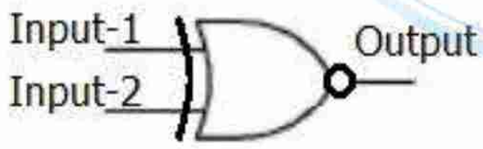
Q.18. Write down the logic expression and table for exclusive OR gate.
Ans. Logic expression for exclusive OR gate is,

$$X = A\overline{B} + \overline{A}B$$

Truth table of exclusive OR gate

Inputs		Output
A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

Q.19. Write down symbols and truth table of exclusive NOR gate.
Ans. Symbol



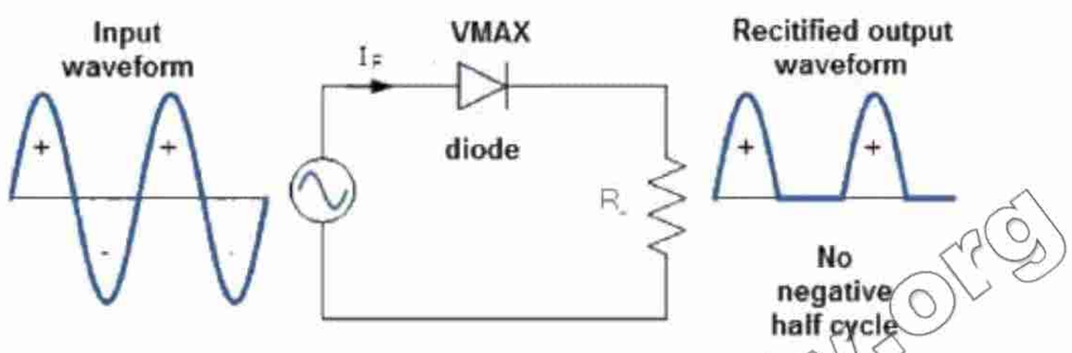
EX-NOR Gate

XNOR Truth Table		
A	B	Q
0	0	1
0	1	0
1	0	0
1	1	1

Q.20. Define rectification? Draw a circuit diagram for half wave rectifier.

Ans. Rectification: The process of conversion of alternating current into direct current is called rectification.

Circuit diagram of half wave rectifier is given below,



Q.21. What is LED? Write its uses.

Ans. Light emitting diodes (LED) are made from special semi-conductors such as gallium arsenide and gallium arsenide phosphide in which the potential barrier between p and n sides is such that when an electron combines with a hole during forward bias conduction, a photon of visible light is emitted. LED is used:

i. As small source of light in decoration e.g, art lighting or night lighting.
ii. For displaying digits etc, in electronic appliances.

Chapter 19

Q.1. Write three results of special theory of relativity.

Ans. i. The clock appears to run slow to the observer at rest. This is example of time dilation.

ii. The length measured in moving spaceship would be smaller than it is measured at rest on earth.

iii. It is impossible to accelerate an object to speed equivalent to that of light in free space.

Q.2. If electron and proton have same De-Broglie wavelength. Which particle has greater speed?

Ans. According to De-Broglie wave length

$\lambda = h/mv$ and v=h/m$\boldsymbol{\lambda}$ where h is Plank's constant.

So mass of proton is greater than the mass of electron so velocity of electron will be greater than the velocity of proton.

Q.3. Define frame of reference? Differentiate inertial frame and non-inertial frame?

Ans. Frame of Reference: A frame of reference is any coordinate system relative to which measurements are taken.

Inertial Frame: A coordinate system in which law of inertia is valid. And acceleration is considered to be zero (a=0).

Non-Inertial frame: A coordinate system in which law of inertia is not valid and body is not moving with constant velocity (a≠0)

Q.4. How time dilation effect the aging process of human body?

Ans. When the observer is at rest, he measures the time slowly comparatively to the observer in motion so if the person is at rest he observes slow aging process.

Q.5. Why is cavity radiator considered as black body?

Ans. A body which absorbs all radiations falling on it, is called black body. A perfect black body does not exist. But a cavity radiator has a small hole in it and it absorbs all radiations fall on it. So the cavity radiator is considered as a black body.

Q.6. Write two postulates of special theory of relativity.

Ans. i. The laws of physics are same in all inertial frames of refernces.

ii. Speed of light has same value for all observers.

Q.7. Define pair production and annihilation of matter.

Ans. Pair Production: A phenomena in which an attempt is made to stop a photon by nucleus of heavy metals, it disintegrate into electron positron pair.

Annihilation of Matter: The phenomena in which a positron come close to an electron, they annihilated and produce two photons with range of radiations.

Q.8. What do you mean by $E=mc^2$?

Ans. This is Einstein's equation of energy-mass relationship. According to this equation energy and mass are inter convertible to into each other, when mass move with the speed of light.

Q.9. Define relative motion?

Ans. The movement of one body with respect to other body is called relative motion.

Q.10. Write the advantages of NAVSTAR navigation system.

A. These are the advantages of NAVSTAR system:

i. The location and speed of anybody on the earth can be measured to an accuracy of 20cm by using relativistic affects.

ii. The location of aircraft after an hour can be predicted to about 50m as compared to 760m determined by using relativistic effects.

Q.11. Define special theory of relativity and general theory of relativity.

Ans. The theory which deals with the inertial frame of references and acceleration is considered to be zero, is called special theory of relativity.

Postulates:

i. The laws of physics are same in all inertial frames of references.

ii. Speed of light has same value for all observers

Q.12. Distinguish general theory of relativity and special theory of relativity.

Ans. Special theory of relativity: The theory which deals with the inertial frame of references and acceleration is considered to be zero, is called special theory of relativity.

General theory of relativity: The theory which deals with the Non- inertial frame of references and acceleration is not zero, is called general theory of relativity.

Q.13. When light shines on the metal surface, is momentum transferred to metal surface?

Ans. Yes, when light shines on the metal surface, is momentum and energy transferred to metal surface.

Q.14. What do you understand by work function and stopping potential?

Ans. Work Function: The minimum energy required to eject the electron form metal surface, is called work function. Its value is different for different metals. It is denoted by **ϕ**.

$$\phi = hf - 1/2\ mv^2$$

Stopping Potential: The external force used to stop ejection of electrons from metal surface, is called stopping potential. It is also called cut-off potential.

$V_0\ e = 1/2\ mv^2$ where V_0 is stopping potential.

Q.15. Define threshold frequency?

Ans. This is the minimum value of frequency below which no electron can eject from the metal surface. Its value depends on the metal surface

Q.16. State uncertainty principle? Give its two mathematical forms.

Ans. Statement: "Position and momentum of a particle cannot be measured simultaneously with accurate value."

Mathematical forms: $\Delta x.\ P \approx h$

$$\Delta E.\ t \approx h$$

Chapter 20

Q.1. Write a note on CAT Scanner?

Ans. CAT stands for Computerized axial tomography. In CAT Scanner, the X-ray produces a thin fan shaped beam that is detected on the opposite side of the subject by several hundred detectors arranged in a line. Each detector measures absorption of X-ray along a thin line through the subject. The entire apparatus is rotated around the subject, in the plane of the beam during a few seconds. The changing reactions of the detector are recorded digitally; a computer processes this information and reconstructs a picture of different densities over an entire cross section of the subject. Density differences of the order of one percent can be detected with CAT-Scans. Tumors and other minute anomalies can be detected by it.

Q.2. Write some uses of laser in medicine and industry?

Ans. Medicine: 1. Laser beams are used as surgical tool for " welding" detached retinas.

2. Finely focused beam of laser has been used to destroy cancerous and pre-cancerous cell.

3. The heat of the laser seals off capillaries and lymph vessels to prevent spread of the disease.

4. The narrow intense beam of laser can be bused to destroy tissue in a localized area. Tiny organelles with a living cell have been destroyed by using laser to study how the absence of that organelle affects the behavior of the cell.

Industry: 1. It can be used for telecommunication along optical fibres.

2. Laser beam can be used to generate three- dimensional images of objects in a process called holography.

3. It is potential energy source for inducing fusion reactions.

4. The precise straightness of a laser beam is useful to surveyors for lining up equipment especially in inaccessible locations.

Q.3. Differentiate an orbital electron from a free electron?

Ans. Orbital electrons are present in orbits around the nucleus of atom and have specific amount of energies whereas free electrons are single (or non paired) electrons in valance shells and may have any amount of energy.

Q.5. How does stimulated emission differ from spontaneous emission?

Ans. Stimulated emission also known as induced emission, in this case the incident photon of energy $hf = E_2 - E_1$ induces an atom to decay by emitting a photon that travels in the direction of the incident photon. For each incident photon we will have two photons giving in the same direction, thus an amplified and an unidirectional coherent beam is produced. Spontaneous emission is the process in which the atom undergoes transition from an excited energy state to a lower energy state by emitting photon of energy $hf = E_2 - E_1$ in any direction.

Q.6. How does K_α X-rays differ from K_β X-rays.

Ans. In X-ray production, when fast moving electrons of energy *Ve* strike a target made of tungsten or other heavy element, in collision, the electrons in the innermost shells, such as K or L, will be knocked out. If one of the electrons in K shell is removed, thereby producing a vacancy or hole in that shell. The electron from the L shell jumps to occupy the hole in the K shell, emitting photon of energy $hf_{k\alpha}$ called **K_α X-rays** and given by $hf_{k\alpha} = E_L - E_K$. It is also possible that the electron from the M shell might also jump to occupy the hole in the K shell. The photons emitted are **K_β X-rays** with energies $hf_{k\beta} = E_M - E_K$.

Q.7. What is difference b/w Bremsstrahlung radiation and characteristic X-rays in production?

Ans. Bremsstrahlung is the Electromagnetic radiation produced by the deceleration of a charged particle when deflected by another charged particle typically an electron by an atomic nucleus. Moving particle losses energy which is converted into photon. The transitions of inner shell electrons in heavy atoms give rise to the emission of high energy X-ray photons. These are called Characteristic X-rays.

Q.8. Write postulates of Bohr's model of H-atom?

Ans. Postulate 1: An electron , bound to the nucleus in an atom can move around the nucleus in certain circular orbits without radiating. These orbits are called discrete stationary states of atom.

Postulate II: Only those stationary orbits are allowed for which orbital angular momentum is equal to an integral multiple of $h/2\pi$ i.e.

$$mvr = nh/2\pi$$

(where **v** and ***m*** velocity and mass of the orbiting electron, ***r*** is the radius of orbit, ***n*** is the principal quantum number, ***h*** is the Planck's constant)

Postulate III: Whenever an electron makes a transition, that is jumps from high energy states E_n to a lower energy state E_p , a photon of energy ***hf*** is emitted so that

$$hf = E_n - E_p$$

Q.9. What happens when an electron losses all of its energy in X-rays?

Ans. When an electron losses all of its energy in collision , an X-ray photon with maximum energy or the shortest wavelength is produced.

Q.10. Differentiate b/w ground state and ionized state of an atom?

Ans. Ground state: The electron in the hydrogen atom is in the lowest energy state corresponding to principal number n =1 and this state is called ground or normal state.

Ionized state: it is the state in which atom acquires a negative or positive charge by gaining or losing electrons.

Q.11. Differentiate b/w line spectrum , band spectrum and continuous spectrum.

Ans. Line Spectrum: When atoms are excited they emit light of certain wavelengths which correspond to different colors. The emitted light can be observed as a series of colored lines with dark spaces in between , this series of colored lines is called a line or atomic spectra.

Band Spectrum: When atoms are excited they emit light of certain wavelength of different colors and they are so close to each other that they appears to be a band, example is molecular spectra.

Continuous Spectrum: This spectrum contains many different colours or wavelengths with no gaps, Black body radiation is its example.

Q.12. Define excitation energy and ionization energy?

Ans. Excitation Energy: The amount of energy required to lift an electron in an atom from its ground state to anyone of the higher allowed states is called excitation energy.

Ionization energy : The amount of energy required to lift an electron in an atom from its ground state to the state at infinity is called ionization energy.

Q.13. Define characteristic X-rays and continuous X-rays?

Ans. Characteristic X-rays: The X-rays emitted in inner shell transition are called characteristic X-rays, because their energy depends upon the type of target material.

Continuous X-rays: The X-rays that are emitted in all directions and with a continuous range of frequencies are known as continuous X-rays.

Q.14. What is meant by Normal population and population inversion?

Ans. A normal population of atomic state is the state with more atomic in the lower energy state E_1 than in the excited state E_2.

A Population inversion is the state in which the higher energy state has a greater population than the lower energy state.

Q.15. Explain what is the difference between laser light and incandescent light?

Ans. Laser Light:

1. Laser light is monochromatic i.e. it consists of one wavelength.

2. It is coherent i.e. light waves are in the same phase.

3. It moves in the same direction.

4. It is produced due to stimulated emission of radiation.

5. it is more intense than the ordinary light.

Incandescent Light:

1. The ordinary light from incandescent source has a number of wavelengths.

2. it has no phase coherent i.e. waves are out of phase.

3. It is emitted in all directions.

4. This is produced by spontaneous emission of light.

5. Its intensity is less.

Chapter 21

Q.1. Define Decay constant?

Ans. The decay constant is the fraction of the number of atoms that decay in 1 second. It is the constant λ in the decay equation: $dN/dt = -\lambda N$. The negative sign indicates decay, dN/dt is the number of decays per second (also known as 'Activity') and N is the number of atoms present.

Q.2. What are the main parts of the nuclear reactor?

Ans. The nuclear reactor has mainly four parts:

- Core
- Moderators
- Control rods
- Heat exchanger

Q.3. Which element has the maximum binding energy per nucleon value and also write its values?

Ans. The binding energy per nucleon is maximum for iron, as iron is the most stable of all the elements and has a maximum value of 8.8MeV at mass number 58.

Q.4. What do you mean by "Dead Time" of a Geiger counter?

Ans. Positive ions are very massive than the electrons they take several hundred times as long to reach the outer cathode. During this time which is called as dead time (10^{-4}s) of the counter, further incoming particles cannot be counted.

Q.5. What is mean by Mass defect and binding energy?

Ans. The mass of the nucleus is always less than the total mass of the protons and neutrons that make up the nucleus. The difference of the two masses is called mass defect. The missing mass is converted to energy in the formation of the nucleus. The work done on the nucleus to separate it into its constituent neutrons and protons is called binding energy.

Q.6. Define atomic number and mass number?

Ans. The combined number of all the neutrons and protons in a nucleus is known as mass number and is denoted by A. The number of all the protons present in the nucleus of an atom is called atomic number and is denoted by Z.

Q.7. How do alpha and beta ionize an atom?

Ans. α- particles can do ionization along its straight path till it loses all its energy and comes to rest. It then captures two electrons from the medium and becomes a neutral helium atom. Beta particles does ionization due to electrostatic repulsion. Beta -particles loses almost all its energy in a single encounter. Ionization path of □□is broken and zigzag sue to its smaller mass.

Q.8. Define (a) Curie (b) Becquerel

Ans. The strength of the radiation source is indicated by its activity measured in Becquerel. One Becquerel (Bq) is one disintegration per second. A larger unit is curie (Ci) which equals 3.78×10^{10} disintegrations per second.

Q.9. What are background radiations? Write their two sources.

Ans. When a Geiger tube is used in any experiment, it records radiation even when a radioactive source is nowhere near it. This is caused by radiation called background radiation. The sources of background radiation are:

- Cosmic radiation: which comes to us from outer space and partly from naturally occurring radioactive substance in earth's crust.
- rocks and soil: some rocks are radioactive and give off radioactive radon gas
- All types of food also contain a little radioactive substance. The most common are potassium-40 and carbon-14 isotopes.

Q.10. What is radio activity?

Ans. Those elements whose charge number Z is greater than 82 are unstable. Some invisible radiations that can affect the photographic plates emanate out of these elements. Such elements are called radioactive and the phenomena is called radioactivity.

Q.11. What is fluorescence? Name two fluorescence substances.

Ans. Fluorescence is the property of absorbing radiant energy of high frequency and re-emitting energy of low frequency in the visible region of electromagnetic spectrum. Zinc sulphide and sodium iodide are the fluorescent substances.

Q.12. Define fission and fusion reaction?

Ans. Such a nuclear reaction in which two light nuclei merge to form a heavy nucleus is called fusion reaction. Such a reaction in which a heavy nucleus like that of uranium splits up into two nuclei of roughly equal size along with the emission of energy during the reaction is called fission reaction.

Q.13. What do you mean by critical mass and critical volume?

Ans. The quantity of mass which is enough to absorb most of all the neutrons produced in fission chain reaction to give tremendous energy, like atom bomb is called critical mass. The volume occupied by a certain mass, usually one gram molecule of a liquid or gaseous substance at its critical point.

Q.14. What are the basic forces? Write the name of basic sources of nature.

Ans. A force can be defined as the push or pull on an object that causes it to change its state of rest or uniform motion. There are four fundamental forces in nature

- Gravitational force
- Magnetic force
- Electric force
- Weak nuclear force
- Strong nuclear force

Q.15. What are Hadrons? Give example.

Ans. Hadrons are particles that experience the strong nuclear force, for example neutrons and mesons.

Q.16. What are leptons? Give example.

Ans. Leptons are the particles that do not experience strong nuclear force, for example electron and neutrinos.

Q.17. Write the names and define three distinct ways of interaction of radiation with matter. Also

give their energy range.
Ans. Radiation interacts with matter in three distinct ways, depending mainly on their energy.

- At low energies (less than about 0.5MeV), the dominant process that removes photons from a beam is the photoelectric effect.
- At intermediate energies, the dominant process is Compton scattering.
- At higher energies (more than 1.02MeV), the dominant process is pair production.