Physics - 2017

General Instructions :

- Group-A has 15 objective type questions each of 1 mark. खण्ड-अ में 15 वस्तुनिष्ठ प्रश्न हैं, प्रत्येक 1 अंक का है।
- Group-B has 8 questions, each of 2 marks. खण्ड-ब में 8 प्रश्न हैं, प्रत्येक का मान 2 अंक है।
- Group-C has 8 questions, each of 3 marks. खण्ड-स में 8 प्रश्न हैं, प्रत्येक का मान 3 अंक है।
- Group-D has 3 questions, each of 5 marks. खण्ड-द में 3 प्रश्न हैं, प्रत्येक का मान 5 अंक है।

Group-A

Q.1. Answer the following questions :

(i) The unit for electric intensity is

(a) Nm^{-1} (b) Vm^{-1}

(c) dyne cm^{-1} (d) Vm^{-2}

Ans. (b) Vm^{-1}

(ii) An electric dipole of moment p is lying along a uniform electric field E. The work done in rotating the dipole by 90° is

(a) $2pE$ (d) $\frac{pE}{2}$

(c) pE (d) $\sqrt{2}pE$.

Ans. (c) pE

(iii) Three capacitors, each of capacitance C are connected in series. Their equivalent capacitance will be

(a) $\frac{C}{3}$ (d) $3C$

(c) $\frac{3}{C}$ (d) $\frac{1}{3C}$.

Ans. (a) $\frac{C}{3}$

(iv) As temperature increases, the resistance of a conductor

(a) remains unchanged (b) increases

(c) decreaes (d) none of these.

Ans. (b) increases

(v) Two cells of e.m.f. E_1 and E_2 d and internal resistances r_1 and r_2 respectively are connected in parallel. Equivalent e.m.f. of the combination is

(a) $\frac{E_1r_2 + E_2r_1}{r_1 + r_2}$ (b) $\frac{E_1r_1 + E_2r_2}{r_1 + r_2}$

(c) $\frac{E_1 + E_2}{2}$ (d) $E_1 + E_2$

Ans. (a) $\frac{E_1r_2 + E_2r_1}{r_1 + r_2}$

(vi) An electron having charge e and mass m is moving in a uniform electric field $\vec{E}$. Its acceleration will be

(a) $\frac{e^2}{m}$ (b) $\frac{e^2\vec{E}}{m}$

(c) $\frac{e\vec{E}}{m}$ (d) $\frac{m\vec{E}}{e}$.

Ans. (c) $\frac{e\vec{E}}{m}$

(vii) The impedance of L-R circuit is

(a) $R^2 + \omega^2L^2$ (b) $\sqrt{R + \omega L}$

(c) $R + \omega L$ (d) $\sqrt{R^2 + \omega^2L^2}$.

Ans. (d) $\sqrt{R^2 + \omega^2L^2}$

(viii) If ϕ be the phase difference between alternating current and e.m.f. then the power factor is

(a) $\tan\phi$ (b) $\cos\phi$

(c) $\sin\phi$ (d) $\cos^2\phi$.

Ans. (b) $\cos\phi$

(ix) In a step-up transformer the numbers of turns in the primary and secondary coils are respectively N_1 and N_2, then

(a) $N_1 > N_2$ (b) $N_1 < N_2$

(c) $N_1 = N_2$ (d) $N_1 = O$.

Ans. (b) $N_1 < N_2$

(x) Direction of propagation of electromognetic waves is

(a) parallel to $\vec{E}$ (b) parallel to $\vec{B}$

(c) parallel to $\vec{B} \times \vec{E}$ (d) parallel to $\vec{E} \times \vec{B}$.

Ans. (d) parallel to $\vec{E} \times \vec{B}$.

(xi) The length of an astronomical telescope in normal adjustment is

(a) $f_o - f_e$ (b) $f_o \times f_e$

(c) $f_o + f_e$ (d) $\frac{f_o}{f_e}$.

Ans. (b) $f_o \times f_e$

(xii) Energy of a photon of wavelength λ is

(a) $hc\lambda$ (b) $\frac{hc}{\lambda}$

(c) $\frac{h\lambda}{c}$ (d) $\frac{h}{c\lambda}$.

Ans. (b) $\frac{hc}{\lambda}$

(xiii) β- particles are fast moving

(a) electrons (b) protons
(c) neutrons (d) photons.

Ans. (a) electrons

(xiv) When a forward bias is applied to a p-n junction, it

(a) raises the potential barrier
(b) reduces the majority carrier current to zero
(c) lowers the potential barrier
(d) none of these.

Ans. (c) lowers the potential barrier

(xv) The Boolean expression for NAND gate is

(a) $A+B=Y$ (b) $\overline{A+B}=Y$
(c) $A.B=Y$ (d) $\overline{A.B}=Y$.

Ans. (d) $\overline{A.B}=Y$.

Group-B

Answer the following questions :

Q.2. State and explain the principle of quantisation of charge.

Ans. It refers to the fact that the observed change is always an integral multiple of 'e' $(1.6\times10^{-19}C)$

i.e. $q=\pm ve$, *where* $n=1, 2, 3, ...$

Q.3. Define the terms magnetic permeability and magnetic susceptibility.

Ans. **Magnetic permieability (μ) :** It is the measure of the ability of a material to support the formation of a magnetic field within itself.
Hence it is degree of magnetization that a material obtains in response to an applied magnetic field.
S.I. unit is Hennes/meter (Hm^{-1}).
Magnetic Susceptibility (X) : It is measure of the magnetic properties of a material. It indicates whether a material is attracted into or repelled out of a magnetic field.

Q.4. The core of the transformer is laminated. Why?

Ans. So, to reduce these eddy current, transformer core is laminated & current is made to travel in a single direction.
Even after laminating the core, we are unable to reduce the eddy current completely but are of negligible magnitude.

Q.5. What are electromagnetic waves? Mention two properties electromagnetic waves.

Ans. A wave produced by the acceleration of an electric charge & propagated by the periodic variation of intensities of, usually perpendicular electric & magnetic fields.
Properties :

(i) It travels with the speed of light in vaccum i.e. $3\times10^{8}m/sec.$
(ii) It is not deflected by electric or magnetic field.
(iii) It shows interference & diffraction.
(iv) It is transverse in nature.

Q.6. Define limit of resolution and resolving power of an optical instrument.

Ans. An optical system with the ability to produce image with angular resolution as good as the instrument's theoretical limit.
It 'f' is the focal length of the optical system then the linear value of Ray light limit of resolution is

$$\sigma=1.21\frac{\lambda f}{D}$$

Q.7. What is nuclear fission? Give an example.

Ans. The nuclei of some atoms decay by breaking into two smaller, more stable nuclei during a process called nuclear fission.
It is the process in which a large nuecleus splits into two smaller nuclei with release of energy.

$^{236}U \rightarrow {}^{92}Kr + {}^{141}Ba$

Q.8. What is a solar cell? Mention two of its applications.

Ans. A solar cell or photovoltaic cell is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect.
Application:
(i) For charging battery
(ii) It is used to supply power to traffic signal.

Q.9. Why are sky waves not used for transmitting TV signals?

Ans. Transmission of TV signal is done with the help of radio waves of frequency ranging between 80 MHz & 200 MHz.
The transmission is not possible via sky wave becaue the ionosphere doesn't reflect those wave back to earth.
Klaves of frequency ranging between 1500 KHz & 30 MHz can be used for communication via sky wave.

Group-C

Answer the following questions:

Q.10. Derive an expression for the energy stored in a charged capacitor.

Ans. The energy (measured in joule) stored in a capacitor is equal to the work done to charge it.
Consider a capacitance 'C' holding a charge +q on one plate -q on the other.
Moving a small element of charge dq from one plate to the other against the potential diff. $v=q/c$ requires the work dkl.

$$dkl=\frac{q}{c}dq$$

Where
W is work measure in joules
q is charge is in coulumb.
c is capacitance measured in farad.

Q.11. The equation of an alternating current is $I=20\sin 200\pi t$. Calculate frequency, peak value and r.m.s. value of current.

Ans. We know that

$$I=Io\sin\omega t$$

AIQ. $I=20\sin 200\pi t$
Comparing both eqn. the peak value of the a.c. is

$$I_o=20A$$

$\because \quad \omega t=200\pi t$

$\Rightarrow \quad 2\pi ft=200\pi t$

$\Rightarrow \quad f=\frac{100\pi t}{2\pi t}$

$\therefore \quad f=100Hz$

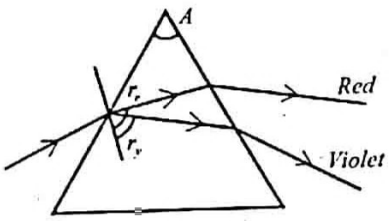
RMS. value of AC

$$=\text{Im}s=\frac{I_o}{V_2}$$

$$=\frac{20}{V_2}$$

Q.12. When a white ray of light passes through a prism, it is dispersed. Why? Why does violet colour deviates most but red colour deviates least while dispersed by a prism?

Ans. In a dispersive medium wavelength (colours) travel with different speed ($M = c/u$). So the refractive index of the material of the prism is diff. for diff. colours. When a light ray strikes a prism all the colours have the same angle of incidence μ. But the angle of refractive r_1 will be different for diff. colours, as $\mu = \frac{\sin i_1}{\sin r_1}$.



Let refractive indices of the material of the prism for violet & red w a v μ_v & μ_r respectively. But $\mu_r > \mu_v$, so the angle of deviation dv for violet light will be greater than the angle of deviation for red. Because $d = (\mu - 1)A$.

So violet colour deviates most but red colour deviates least.

Q.13. Focal length of a convex lens in air is 20 cm. Find its focal length when immersed in water. Given $\mu_g = \frac{3}{2}, \mu_w = \frac{4}{3}$.

Ans. Lens in air, focal length $= f_0 = 20cm$.

$$\mu a = 1,\ \mu g = \frac{3}{2}$$

$$\therefore \quad \frac{1}{20} = \left(\frac{\mu g}{\mu a} - 1\right)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$$

$$= \left(\frac{3}{2} - 1\right)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$$

$$\frac{1}{20} = \frac{1}{2}\left[\frac{1}{R_1} - \frac{1}{R_2}\right] \qquad ...(1)$$

Lens in water.

$$\frac{1}{f_w} = \left(\frac{3}{2} \times \frac{3}{4} - 1\right)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$$

$$= \frac{1}{8}\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$$

$$\frac{f_w}{20} = \frac{1}{2} \times 8$$

$$f_w = 4 \times 20 = 80cm$$

Q.14. With reference to photoelectric effect define the terms work function, threshold frequency and stopping potential.

Ans. **Klorte function (W_o) :** It is the minimum energy which is just sufficient to liberate electrons from the surface of the metal with zero velocity. When the energy is supplied in the form of light it is called photoelectric work function.

It's unit is electron volt.

Thereshold frequency (V_o) : The minimum frequency of the radiation incident on a metal surface below which there is no photoelectric emission is called threshold frequency.

Stopping potential : The stopping potential is the retarding p.d. needed to just stop the most energetic photo electrons emitted frmo the photo-sensitive metal.

It Vs is the stopping pot. applied between the emitter & the collecting electrod to prevent the photoelectron leaving the photosensitive metal. Then,

$$eV_s = \frac{1}{2}mV_{max}^2.$$

Q.15. What is radioactivity? Derive the relation $N = N_0 e^{-\lambda t}$, where terms have their usual meanings.

Ans. The spontaneous emission of highly penetuating radiation (α-particle, β-particle and γ-rsys) from heavy elements, of atomic weight greater than 206 is called "natural radioactivity". It is a self-disintegrating and irreversible process. It is unaffected by pressure, temperature, large electric and magnetic field.

Derivatin of $N = N_o e^{-\lambda t}$: The rate of disintegration per second (i.e., the number of atoms disintegrating per second) is directly proportional to the total numbr of radioactive atoms present at that time.

Let at time $t = 0$, the number of radioactive atom present be No and at time t the number be N.

Let dN atoms disintegrate in a time dt. Then, $\frac{dN}{dt} \propto -N$

$or\ \frac{dN}{dt} = -\lambda N$, where λ is the decay constant or disintegration constant. Negative sign shows that as time increases, N decreases.

$$\frac{dN}{N} = -dt.\ Integrating.\ \log_e N = -\lambda t\ tc$$

When $t = 0, N = N_o$,

So, $\log_e N_o = Otc$

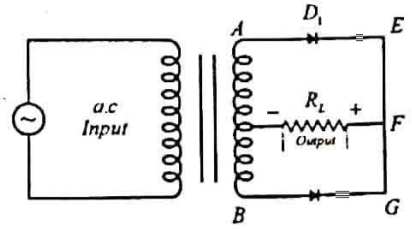
$$\therefore \quad \log_e N = -\lambda t + \log_e N_o$$

$$\log_e = \frac{N}{N_o} = -\lambda t$$

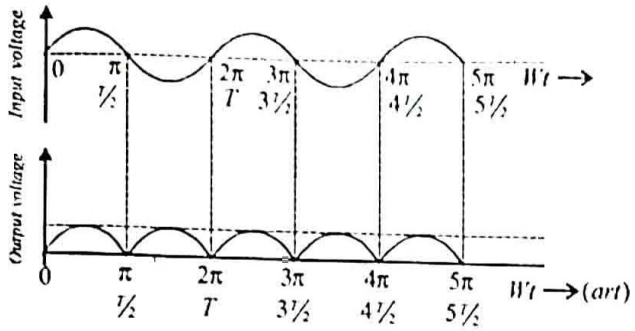
$$N = N_o e^{-\lambda t}$$

Q.16. Describe with circuit diagram the working of a *p-n* junction diode as a full wave rectifier.

Ans.



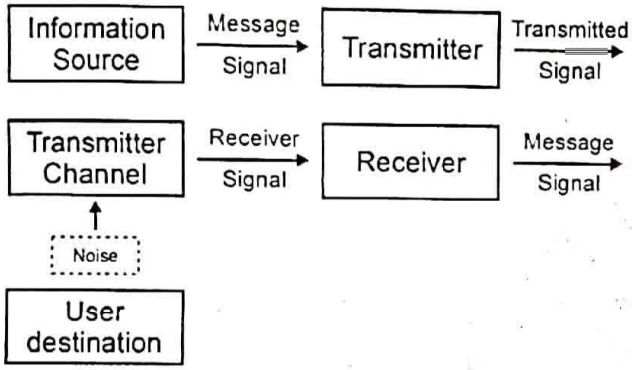
During the positive half of the input a.c. the terminal A of the secondary winding of the transformer is positive and hance D_1 is forward baised. The endBis negative and hance D_2 is revers baised.



Thus current flows through the diode D_1 and through R_L in the direction $D_1EFR_LDAD_1$. During the negative half cycle of a.c. D_1 is reverse-baised and so no current flows. D_2 is forward baised and so it conducts. A current flow through R_L in the direction $D_2GFR_LDBD_2$. Thus the current flowing through R_L in the same direction from F to D in the both half cycles of the input a.c. The d.c. output obtained across R_L is pulsating [in fig.1.2] This is smoothened using filter circuit.

Q.17. What are the essential elements of communication system? Explain briefly with block diagram.

Ans.



The main parts of a communication system are,

(i) The source of information or message signal,

(ii) The transmitter (iii) The channel and

(iv) The receiver.

The physical medium which connects the transmitted and the receiver is caled the channel. It may be open space or coaxial cable or optical Fibres. The transmitter gets the signal from the source and converts into a suitable form so that it can propaget through the channel over very long distances. The receiver may be located at a distant place, receives the modulated signal and converts back into the original information or message signal.

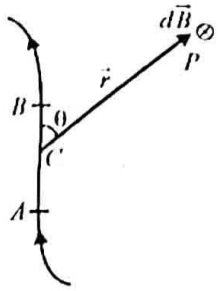
Group-D

Answer the following questions:

Q.18. What is Biot-Savart Law? Derive an expression for magnetic field at a point on the axis of a current carrying circular coil.

Ans. Biot-Savart's Law : Biot-Savart's law is used to determine the strength of the magnetic field at any point due to a current carrying conductor.

Consider a very small element AB of length dl of a conductor carrying current I. The strength of magnetic field dB due to this current at P from the element is found to depend upon quantities as under :



(i) $dB \propto dl$ (ii) $dB \propto I$

(iii) $dB \propto \sin\theta$, where θ is the angle between $d\vec{l}$ and $\vec{r}$

(iv) $dB \propto \frac{1}{r^2}$

Combining (i) to (iv), we get, $dB \propto \frac{Idl\sin\theta}{r^2}$

i.e., $dB = K\frac{Idl\sin\theta}{r^2}$ ...(i)

Where K is a constant of proportionality.

In SI units, $K = \frac{\mu_o}{4\pi}$

where, μ_o is called absolute permeability of free space i.e. vacumm.

value f μ_o in SI unit $= 4\pi\times10^{-7}TmA^{-1}$ or $Wbm^{-1}A^{-1}$

$\therefore \quad \frac{\mu_o}{4\pi} = 10^{-7}TmA^{-1}$

Hence eq^n. (i) can be written as

$$dB = \frac{\mu_o}{4\pi}.\frac{Idl\sin\theta}{r^2}$$

Magnetic field at a point on the axis of current carrying circular coil/loop : Suppose current I is flowing in the circular loop of radius a. we have to find out the magnetic field at P due to this circular loop. dl is the small current element, at distance r from P.

$$dB = \frac{\mu_o}{4\pi}.\frac{I.dl.\sin\theta}{r^2}$$

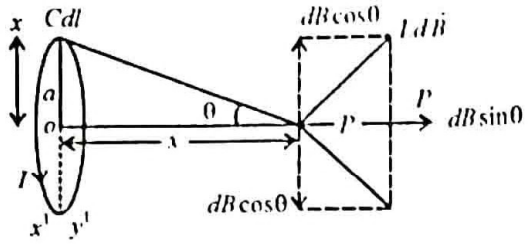
Hence, $or = \frac{\pi}{2} = 90°$

$$dB = \frac{\mu_o}{4\pi} = \frac{I.dl.\sin 90°}{r^2}$$

or, $dB = \frac{\mu_o}{4\pi} = \frac{I.dl}{r^2}$ $[\because \sin 90° = 1]$

dB at P is divided into two components. $dB\sin\theta$ along the axis and $dB\cos\theta$ normally to the axis. The value of XY and X^1Y^1 are equal but opposite. Therefore $dB\cos\theta$ and $dB\sin\theta$ cancel each other.

Hence, the magnetic field at P due to the circular loop is the sum of $dB\sin\theta$.



or, $B = \Sigma dB \sin\theta$

$B = \int dB \sin\theta$

putting the value of dB,

$$B = \int \frac{\mu_o}{4\pi} \cdot \frac{I.dl}{r^2} \sin\theta = \frac{\mu_o I \sin\theta}{4\pi r^2} \int dl.$$

but, $\int dl = circumference\ of\ the\ loop = 2\pi a$

$$\therefore \quad B = \frac{\mu_o . I . \sin\theta}{4\pi r^2} \times 2\pi a$$

Again, in right angle triangle COP.

$$\sin\theta = \frac{a}{r}$$

$$B = \frac{\mu_o I . a . 2\pi a}{4\pi r^2 . r} = \frac{\mu_o I 2\pi a^2}{4\pi r^3}$$

or, $$B = \frac{\mu_o I . 2\pi a^2}{4\pi (a^2 + x^2)^{3/2}}$$

Or

Q. Describe with principle, the construction and working of cyclotron.

Ans. Cyclotron :

Principle : It works on the following principle: when a positively charged particle is made to move time and again in a high frequency electric field and using strong magnetic field, it gets accelerated and aquires sufficiently large amount of energy.

Construction : It consists of two hollow D-shaped metallic chambers D_1 and D_2 called dees. These dees are separated by a small gap where a source of positively charged particles is placed.

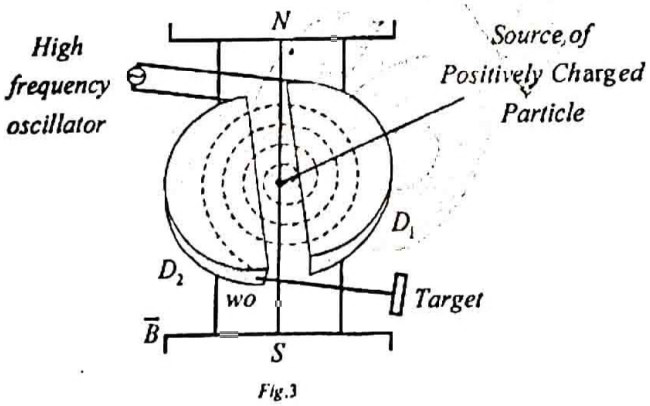


Fig.3

Dees are connected to high frequency oscillator, which provides high frequency electric field across the gap, of the dees. The particles inside the dees are shielded from electric field but the magnetic field acts on them and makes them move in circular paths in the dee. Reversal of the polarity of electric oscillation ensures that the particle is always accelerated by the electric field. Radius of the circular path increases with increase in acceleration, so path of the particle becomes a spiral. This arrangement is placed between two poles of a strong electromagnet. The magnetic field due to this electromagnet is perpendicular to the plane of dees.

Working : If a positively changed particle is emitted from source, when dee D_2 is negatively charged and D_1 is positively charged, it will accelerate towards D_2. As soon as it enters D_2, it is shielded from the electric field by the metallic chamber. Inside D_2, it moves at right angle to the magnetic field and hence describes a semi-circle it enters the gap between the dees have been reversed. Now the proton is further accelerated towards D_1. Then it enters D_1 and again describes the semi-circle due to the magnetic field which is perpendicular to the motion of the proton. This process conditions till the proton reaches the periphery (i.e., external boundary) of the dee system. At this stage the proton (or a heavy charged particle) is deflected by the deflecting plate, which them comes out through the window (W) and hits the target.

Q.19. Define drift velocity and derive an expression for it. Deduce Ohm's law using the concept of drift velocity.

Ans. Drift velocity (V_d) : It is defined as the average vel. with which free e^- in a conductor get get drifted in a direction opposite to the direction of the applied electric field.

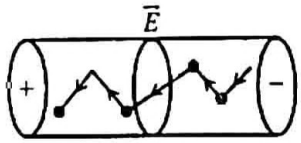
A conductor is an electric field $\vec{E}$. The force experienced by free e^- is $\vec{F} = -e\vec{E}$

-ve sign shows that the direction of $\vec{F}$ & $\vec{E}$ are opposite to each other.

Acceleration produced in the e^- is given by

$$\vec{a} = \frac{\vec{F}}{m},\ m = mass\ of\ e^-.$$

$$\vec{a} = \frac{-e\vec{E}}{m}$$



The small internal of time between two successive collosion between e^- & ion in the conductor is called relaxation time or mean free time (τ).

$\therefore$ drift velocity is given by

$$\vec{v_d} = \vec{u} + \vec{a}\tau$$

or, $$\vec{v_d} = 0 + \frac{-e\vec{E}}{m}\tau$$

$$\vec{v_d} = \frac{-e\vec{E}}{m}\tau$$

i.e., $$\left|\vec{v_d}\right| = v_d = \frac{eE}{m}\tau$$

Deviation of Ohm's law using different velocity $\vec{v_d}$:

Let v_d be the drift velocity of e^- through a section of conductor of length 'l' & cross-sectional area 'A'. 'V' is the p.d. across the

section of conductor, & E is electric field.

The electric current is the conductor is

$$I = neAv_d$$

where, n = *no. of e^- / unit volume in the conductor*

But, magnitude of drift velocity.

$$v_d = \frac{eE\tau}{m}$$

$$= \frac{eV\tau}{ml} \left[\because E = \frac{V}{l}\right]$$

$$\therefore \quad I = neA\left(\frac{eV\tau}{ml}\right)$$

$$= ne^2\frac{A\tau}{ml}V$$

$$\Rightarrow \quad \frac{V}{I} = \frac{ml}{ne^2A\tau} = constant = R$$

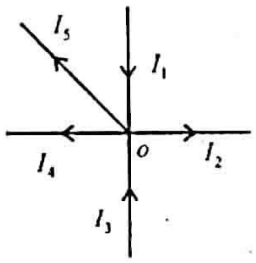
Or

Q. State Kirchhoff's laws for electric circuit. With the help of these laws obtain the condition for balance of a Wheatstone bridge.

Ans. There are two types of Kirchoff's law :

(i) Junction law or current law : It state that the sum of all currents entering any pont or junction must be equal to the sum of all currents having that point.

i.e. $\Sigma I = O$

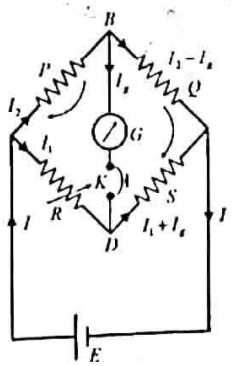


(ii) Loop law or voltage law : It state that the algebric sum of all voltage i.e. the p.d. across all elements & e.m.f. foo all sources in any closed electrical ckt is zero.

i.e. $\tau E + \tau\Delta V = 0.$

Condition for balance point of W.B. : W.B. is an arrangement of four resistor in the term of a bridge. It is used for measuring are unknown resistor in teams of then three known resistors.

Proof : When key K is closed, the current following in the different arms of W.B. are marked according to Kirchoff's first law as in fig.



Applying Kirchhoff's loop law to the closed loop ABDA, we get,

$$-I_2P - I_gG + I_1R = 0 \qquad \ldots (i)$$

Ily for closed loop BCDB, we get,

$$-(I_2 - I_g) + (I_1 + I_g)S + I_gG = 0 \qquad \ldots (ii)$$

When W.B. is balanced

$I = 0$ through galvanometer.

$\therefore$ eq". (i) becomes

$$-I_2P + I_1R = 0$$

$$\Rightarrow \quad I_1R = I_2P$$

$$\Rightarrow \quad \frac{I_1}{I_2} = \frac{P}{R} \qquad \ldots (iii)$$

& eq". (ii) becomes

$$-I_2Q + I_1S = O$$

$$\Rightarrow \quad I_1S = I_2Q$$

$$\Rightarrow \quad \frac{I_1}{I_2} = \frac{Q}{S} \qquad \ldots (iv)$$

from eqn. (iii) & (iv) we get,

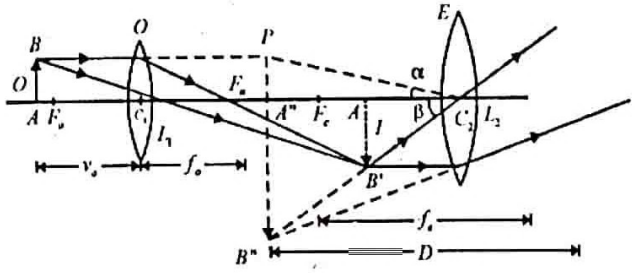
$$\frac{P}{R} = \frac{Q}{S}$$

$$\Rightarrow \quad \frac{P}{Q} = \frac{R}{S} \quad \textit{which is required condition.}$$

Q.20. Draw a lebelled diagram to show the formation of image of an object in a compound microscope. Derive an expression for its magnifying power.

Ans. A compound microscope consist of two suitable lenses to give large magnification by compounding the magnification given the lenses.

Let AB be an object which lies between f_o & $2f_o$ of lens L_1. The real, inverted & magnified image A'B' is formed on the other side of this lens L_1. The position by the lens E or L_2 is adjvited in such a way that image A"B"of A'B' in formed on the same side at a least distance of distinct vision. A"B" is virtual, inverted & highly magnified.



Let $< PC_2'A" = \alpha =$ angle subtended by the object of the eye when placed at the distance of distinct vision.

& $< A"C_2B" = \beta =$ angle subtended by the final image at the eye when placed at the distance of distinct vision.

$$M.P. = \frac{\beta}{\alpha} \qquad \ldots(i)$$

$\because$ α & β are small angles, so using the relation

$\theta = \frac{l}{r}$ we get

$$\beta = \frac{A''B'}{C_2A''} \& \ \alpha = \frac{PA''}{C_2A''} \qquad ...(ii)$$

using equation (i) becomes

$$M.P = \frac{A''B''/C_2A''}{PA''/C_2A''}$$

$$= \frac{A''B''}{PA''} \qquad ...(iii)$$

$\because \quad PA'' \simeq AB$

$$\therefore \quad M.P = \frac{A''B''}{AB} \qquad ...(iv)$$

Multiplying & dividing R.H.S. of (iv) by A'B' we get,

$$M.P = \frac{A''B''}{AB} \times \frac{A'B'}{A'B'}$$

$$= \frac{A''B''}{A'B'} \times \frac{A'B'}{AB}$$

But magnification for eye lens

$$me = \frac{A''B''}{A'B'} \qquad ...(v)$$

Hence equation (v) can be written as

$$M.P = m_o \times m_e$$

Determination q m_o

$$m_o = \frac{A'B'}{AB} = \frac{v_o}{-v_o} \qquad ...(vi)$$

Determination of m_e

$$m_e = \frac{A''B''}{A'B'} = \frac{v}{v_e} \qquad ...(vii)$$

$\because$ final image is formed at a dist. of distinct vision, so $v = D$.

eq^n. (vii) becomes

$$m_e = \frac{D}{u_e} \qquad ...(viii)$$

for an eye piece.

$$\frac{1}{u} + \frac{1}{u} = \frac{1}{f_e}$$

using sign convention $u = -ve, v = -D$

we get $\frac{1}{-u_e} + \frac{1}{(-D)} = \frac{1}{f_e}$

$$\Rightarrow \quad \frac{1}{u_e} - \frac{1}{D} = \frac{1}{f_e}$$

Multiplying both side by 'D' we get

$$\frac{D}{u_e} - 1 = \frac{D}{f_e}$$

or, $\frac{D}{u_e} = \left(1 + \frac{D}{f_e}\right)$ ..(ix)

substituting the value of eqn. (ix) in eqn. (viii) we get,

$$m_e = \left(1 + \frac{D}{f_e}\right) \qquad ...(x)$$

using eqn. (vi) & (x) in eqn. (vi) we get

$$M.P = \frac{u_o}{-u_e}\left(1 + \frac{D}{f_e}\right)$$

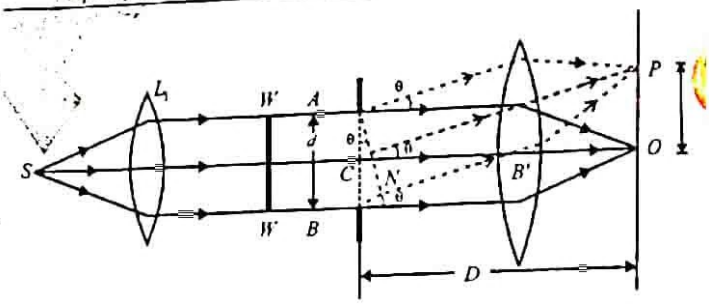
length of microscope, $L = u_o + u_e$

$$\therefore \quad M.P. = \frac{L}{f_o}\left(1 + \frac{D}{f_e}\right)$$

Q. Distinguish between interference and diffraction of light. Explain the diffraction of light by a single slit.

Ans.

	Interference		Diffraction
(i)	It is due to the super position of two wave front originating from two coherent sources.	(i)	It is due to the superposition of secondary wavelete originating from the different point of the same wavefront.
(ii)	In intenference pattern the dirk fringes are usually protectly dark.	(ii)	In diffraction pattern the dark fringes are not perfectly dark.
(iii)	In interference, bands are equally spaced.	(iii)	In diffraction bands are unequally spaced



Divergint light from monochromatic source S is made parallel after refraction through convex lens L_1. The refracted light from L_f is propagated in the form of plane wavefront WW'. The plane wavefront WW' is incident on the slit AB of width 'd'. According to Huygens' principle, each point of slit AB acts as a source of secondary disturbance of wavelets. Convex lens L_2 helps in converging the parallel beam. Now consider a point O on the screen which is placed at a distance D from the slit AB. Since point O is equidistant from points A and B reach the point O in the same phase and hence the constructive interference takes place at O. In other words, O is the position of central maximum.

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