Q11. A convex lens of focal length 25 cm is placed coaxially in contact with a concave lens of focal length 20 cm. Determine the power of the combination. Will the system be converging or diverging in nature?

Answer: We know that power of two lenses kept in contact is given by P = P1 +P2

Here f_1=+25 cm=+25/100 m=1/4 m hence $P_1=1/f_1$=+4 Dioptre,

f_2=-20cm=-20/100=1/5 m, hence $P_2=1/f_2$

Therefore power of the combination P=+4-5=-1 Dioptre

Since Power is negative hence system will behave as diverging in nature.

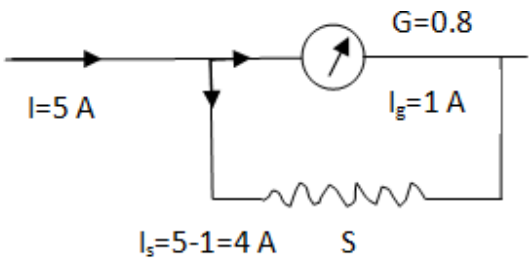
Q12. An ammeter of resistance 0.80 Ω can measure current up to 1.0A.

(i) What must be the value of shunt resistance to enable the ammeter to measure current up to 5.0A?

(ii) What is the combined resistance of the ammeter and the shunt?

Answer:

We know for shunt resistance is connected in parallel to ammeter. Here G=Ammeter Resistance, S=Shut resistance, Ig=Current through Ammeter, Is=Current through Shunt as shown



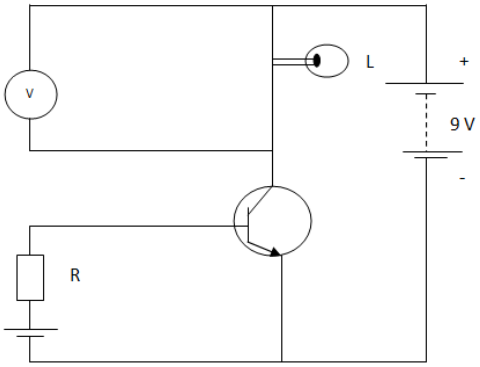
(i) To measure higher current shut resistance(S) to be connected in parallel to Ammeter.

From the diagram, S x Is = G x Ig or Sx4=0.8x1 or S=0.8/4=0.2Ω

(ii) Shut resistance and Ammeter resistance in parallel there equivalent resistance =

$$R = \frac{R \times S}{R + S} = \frac{0.8 \times 0.2}{0.8 + 0.2} = 0.16\Omega$$

Q13. In the given circuit diagram, a voltmeter 'V' is connected across a lamp 'L'. How would (i) the brightness of the lamp and (ii) voltmeter reading 'V' be affected, if the value of resistance 'R' is decreased? Justify your answer.



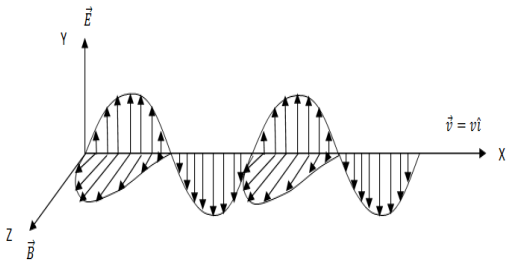
(i) In the transistor circuit if R decreased , base current I_b will increase, but the gain of the transistor $\beta = \frac{I_c}{I_b}$, if I_b increases collector current I_c will also increase to keep β same. As more current I_c flows to lamp, power dissipated by lamp will increase hence brightness of the lamp will increase.

(ii) Since more current flows to the lamp, hence potential drop will increase and voltmeter reading will increase.

Q14. (a) An em wave is travelling in a medium with a velocity $\vec{v} = v\hat{\imath}$. Draw a sketch showing the propagation of the em wave, indicating the direction of the oscillating electric and magnetic fields.

(b) How are the magnitudes of the electric and magnetic fields related to the velocity of the em wave?

Answer:



(a) We know electric and magnetic vectors vibrate perpendicular to each other and propagation of em wave is perpendicular to the plane containing electric and magnetic vector. Therefore since prorogation is along X axis, as per right handed system of axis Electric vector along Y axis and Magnetic vector along Z axis as shown.

(b) Velocity of em wave is ratio of magnitude of electric vector to the magnitude of magnetic vector.

$$C = \frac{|\overrightarrow{E_m}|}{|\overrightarrow{B_m}|}$$