Q16. How is the mutual inductance of a pair of coils affected when:

(I) Separation between the coils is increased?

(II) The number of turns of each coil is increased?

(III) A thin iron sheet is placed between the two coils, other factors remaining the same?

Explain your answer in each case.

Answer:

(I) When the separation between the two coils is increased, flux that is lines of force cutting the secondary decreases so the mutual inductance decreases.

(II) Mutual inductance is proportional to the product of number of turns in coils ($M \propto N_1 N_2$) Hence Mutual inductance increases when the number of turns in each coil is increased,

(III) Mutual inductance is proportional to the permeability $M \propto \text{permeability}\ (\mu)$. Iron sheet being ferromagnetic has higher permeability allows more lines of force (flux) to pass through , hence when an iron sheet is placed between the two coils the mutual inductance M increases.

Q17. A convex lens made up of glass of refractive index 1.5 is dipped, in turn, in:

(I) Medium A of refractive index 1.65

(II) Medium B of refractive index 1.33

Explain, giving reasons, whether it will behave as a converging lens or a diverging lens in each of these two media.

Answer:

(I) Given refractive index of glass = 1.5, refractive index of medium A =1.65. Therefore focal length f_A in medium A

$$f_A = \left(\frac{1.5}{1.65} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = -\frac{0.15}{1.65}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

Since focal length f_A is negative hence the lens is diverging in nature.

(II) Given refractive index of glass=1.5, refractive index of the medium B = 1.33, therefore focal length F_B in medium B $f_B = \left(\frac{1.5}{1.33} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = \frac{0.17}{1.33}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

Since f_B is positive hence the lens is converging in nature.

Q18. Define the terms threshold frequency and stopping potential in relation to the phenomenon of photoelectric effect. How is the photoelectric current affected on increasing the (I) frequency (II) intensity of the incident radiations and why?

Answer:

Threshold frequency: The minimum frequency of incident radiation which can emit electrons from a metal is called *threshold frequency*. If the frequency of incident light is below the threshold frequency, photo-electric emission will not happen.

Stopping Potential: On heating metal plate by filament it emits photo electrons, to collect these photo electrons other plate (anode) kept at positive potential, however if we make collector at negative potential it will repel emitted electrons. The minimum negative potential given to the anode of a photocell for which the photoelectric current becomes zero is called *stopping potential*.

(I) The increase of frequency of incident radiation has no effect on the photoelectric current.

(II) The photoelectric current increases proportionally with the increase in intensity of incident radiation.