11.02.25

PHYSICS

OPTICS

UNIT - 1

B.SC (SEM-IV)

2023-27

TITLE :- Interference of light in thin film :-

* - Condition of maxima and minima in Reflected Light :-

The two rays will reinforce each other if the path difference between them is an integral multiple of λ i.e. when

$$2\mu t \cos r - \lambda/2 = n\lambda, \quad n = 0, 1, 2 \text{ --- etc}$$

$$2\mu t \cos r = (2n+1)\lambda/2 \text{ (Condition of maxima)} \quad (2)$$

When this condition is satisfied, the film will appear bright in the reflected light

Again, the two rays will destroy each other if the path difference between them is the odd multiple of $\lambda/2$ i.e. when

$$2\mu r \cos r - \lambda/2 = (2n-1)\lambda/2 \quad n = 1, 2, 3 \text{ ---}$$

$$2\mu r \cos r = n\lambda \text{ (condition of maxima)}$$

Path difference in transmitted Light :-

The path diff. between the transmitted ~~light~~ rays BT_1 and DT_2 is similarly given by

$$\Delta = \mu(BC + CD) - BL$$

$$= 2\mu r \cos r$$

If Light travels from denser to rarer medium, there is no change in phase due to reflection at B or C.

Hence the effective path difference BT_1 and DT_2 is also $\boxed{2\mu r \cos r}$

[illegible]:- Conditions for Maxima and Minima in Transmitted Light :-

The two rays BT_2 and DT_2 reinforce each other if

$$2\mu t \cos r = n\lambda \text{ (condition of maxima)} \quad (4)$$

When $n = 1, 2, 3, \ldots$

The flim will therefore appear bright in the transmitted Light.

Again the two rays will destroy each other, if

$$2\mu t \cos r = (2n+1)\frac{\lambda}{2} \text{ (condition of minima)} \quad (5)$$

Where $n = 0, 1, 2, 3 \ldots$ and the flim will appear dark in the transmitted light.

A comparision of equation (2), (3), (4) and (5) shows the conditions for maxima and minima in reflected light are just reverse of those in transmitted light.

Hence the flim which appears bright in the reflected light will appear dark in transmitted light and vice-versa.

Production of colours in thin flim:

When a thin flim is illuminated by mono chromatic light and seen in reflected light, it appears bright or dark according to $2\mu t \cos r$ is $(2n+1)\lambda/2$ or $n\lambda$ respectively. If however, the film is exposed to an extend source of white light. It shows beautiful colours

The reason is as follows :-

The eye follows the film receives rays of light reflected at the top and bottom surfaces of the ~~film~~ film. These rays are in the position of interfere. The path difference between the interfering rays ~~an~~ depends upon thickness of flim. and upon r and hence upon the inclination of the incident rays. Now the white light consists of a continuous range of wavelength (colours). At particular range of of the flim and for a particular position of eye the rays of only certain wavelengths will have a path difference satisfying the condition of maxima. Hence only those wavelengths (colours) will be present with maxima intensity. other hands neighbouring wavelengths will be present with less intensity. While some other ~~of the~~ flim which satisfy the condition of minima will be missing. Hence the point of the flim will appear coloured.